Welding Engineer

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JULY, 1958

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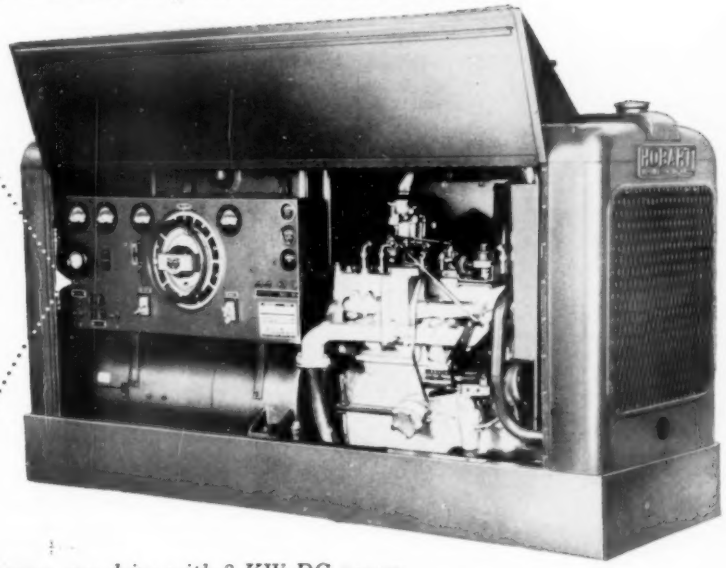

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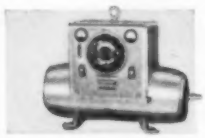

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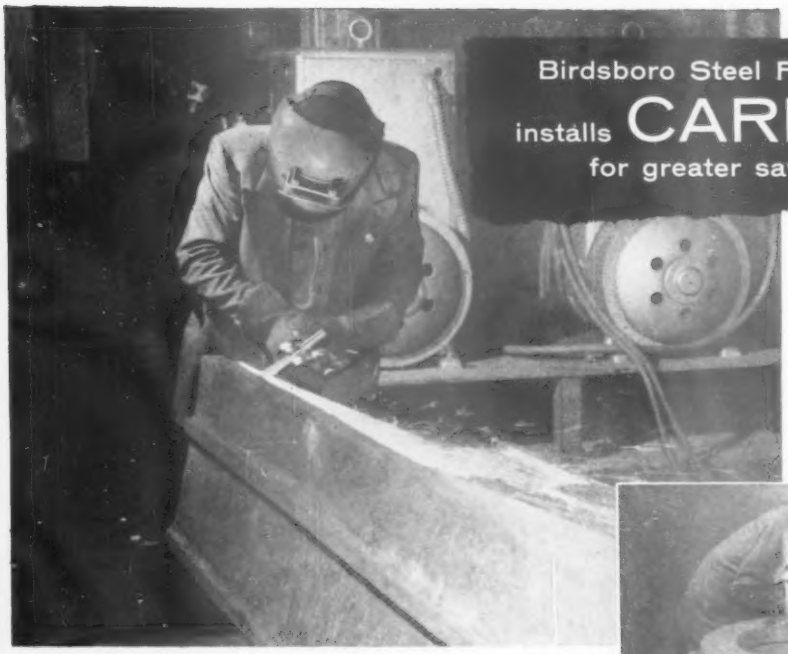
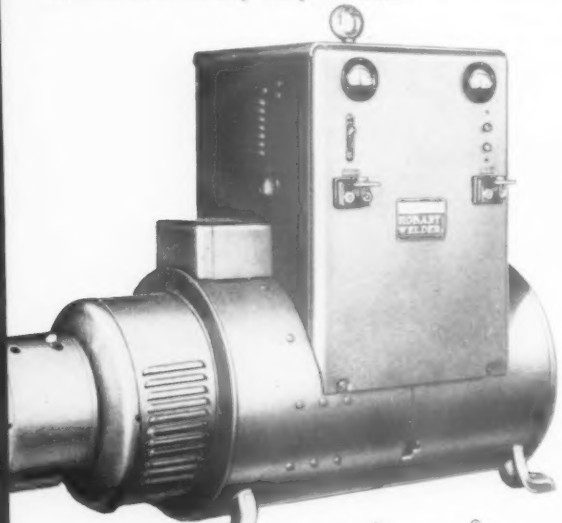


Birdsboro Steel Foundry and Machine Co. installs CARBONAIRE— for greater savings in cleanup time

You, too, can save with "CARBONAIRE" and Arcair*! Simply connect the Arcair* torch to a Hobart "CARBONAIRE" unit plus ordinary compressed air and you have the cost-cutting answer to your metal removing problems. Much faster than chipping and more economical than other methods on many applications.

Cleaning up hydraulic press casting with Arcair carbon holding torch connected to Hobart "CARBONAIRE" electric unit and ordinary compressed air.*

Contour forming of coupling casting with Arcair carbon holding torch connected to Hobart "CARBONAIRE" electric unit and ordinary compressed air.*



Birdsboro Steel Foundry and Machine Co., one of the world's largest producers of Steel Mill Machinery, Hydraulic Presses, Crushing Machinery, Special Machinery, Steel Castings, Weldments and Rolls, has installed Hobart "CARBONAIRE" machines for foundry cleaning room operations at its Birdsboro (Pa.) Plant.

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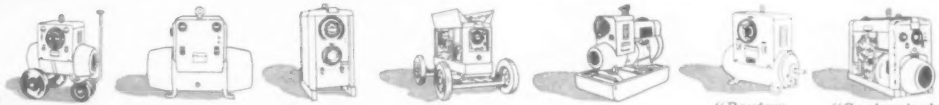

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Vol. 43 — No. 7

The magazine of joining and severing materials

This is welding: July, 1958

This is maintenance in a heavy industrial plant 28

F. T. Tancula describes Caterpillar Tractor Co.'s maintenance welding operations, many of which involve fabrication of new parts for production line use.

Dow: where maintenance welding entails production problems 30

In the pipe shop at Dow Chemical Co.'s Midland plant, **Jack Fairlie** finds that a broad range of metals must be handled by weldors proficient in several processes.

Steel mills look to E3N12's for high strength in high heat 32

Extra qualities required of hardfacing alloys used for maintenance where high temperatures are common is described by one manufacturer of the E3N12 alloy.

Selection, welding of CrMo alloy steel pipe 34

Jay Bland of Standard Oil Co. (Ind.) begins a two-part series by reviewing the determining factors in selecting chrome-moly steel pipe and filler metals for welding it.

Welding and stainless maintain water turbines 38

Lloyd McWilliams speaks from long experience as he describes procedures involved in reclaiming worn guide-bearing sleeves on turbines.

Less cost and better appearance through welded bridges 50

Here's why welding's versatility and reliability give today's bridge designers economy, help them overcome the bugaboo of failure, and permit a wider selection of structural shapes.

Also in this issue:

Mig and Tig weld dynamite mixers 37
Steel plant gondola cars are welded 41
Mig weld aluminum for prefab substations 44
Arc vs. gas welding on gray cast iron 48
Fins for sure 55

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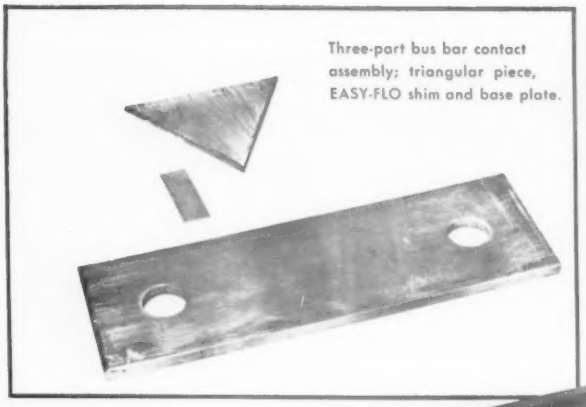

Three-part bus bar contact assembly; triangular piece, EASY-FLO shim and base plate.

Assembly under heat.

Note smooth, even fillet of completed assembly.

EASY-FLO "Moves in All Directions" to Braze Bus Bar Contact

Specialty Brazing Laboratory, Riverside, Connecticut, brazes, among other things, a bus bar contact for Rolock, Inc., Fairfield, Connecticut, makers of fabricated metal products. While a relatively simple assembly, it points up the remarkable *fluidity* of Handy & Harman Silver Brazing Alloys.

Both assembly components are copper. Base plate dimensions are ¼" x 8¾" x 2¾", and the ⅛" thick triangular piece is 3" on its base with 2⅞" sides.

After cleaning, the joint area of the base plate is HANDY-FLUXED and a shim of EASY-FLO 45 is placed on the base plate and the triangular piece set upon the shim. Heating by Selas gas-air burners is done on a 50-second cycle. Alloy cost is approximately four cents per assembly.

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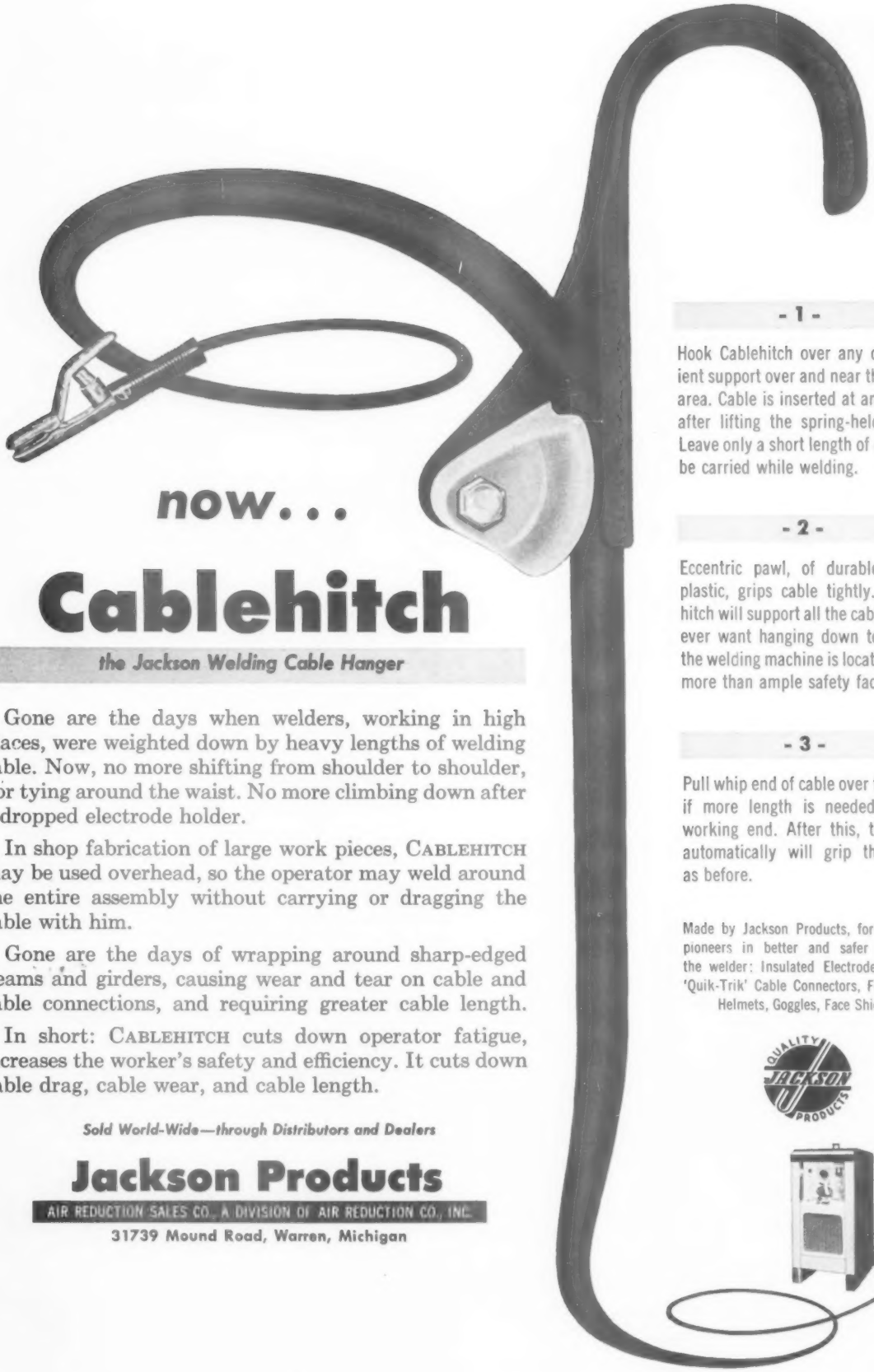

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In shop fabrication of large work pieces, CABLEHITCH may be used overhead, so the operator may weld around the entire assembly without carrying or dragging the cable with him.

Gone are the days of wrapping around sharp-edged beams and girders, causing wear and tear on cable and cable connections, and requiring greater cable length.

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NEWS

Linde-U.S. Steel team up on oxygen supply network

In the steelmaking industry, use of oxygen has climbed from 30 cu ft per ton in 1930 to today's national average of 200 cu ft for every ingot ton produced. Now, about half of a steel mill's oxygen usage is in such practices as scarfing, cutting and scrap preparation—the other half is used in the steelmaking process itself.

With a new record-breaking oxygen plant and pipeline system, Linde Co. and U. S. Steel Corp. are casting their votes for even wider use of oxygen in the steelmaking industry. The new 1,000 ton-per-day plant gives the equivalent of 730 million cu ft of 99.5% pure oxygen per month.

It will serve four of U. S. Steel's plants on the Monongahela river south of Pittsburgh: Homestead, Edgar Thomson, Duquesne and the National Works, National Tube Div. Located at the Duquesne works, the plant will distribute oxygen to the other three by pipeline. Future plans call for extension of the pipeline to a fifth location—Carrie Furnaces.

Use of oxygen has become a low-cost alternative to building additional furnace capacity. The Monongahela Valley plant replaces Linde oxygen facilities installed in the Homestead, Thomson and National Works plants, and will add to Duquesne's new 500 ton-per-day plant.

Harris distributors meet in Cleveland

An annual distributor's meeting was recently held at Harris Calorific Co.'s Cleveland offices. From all parts of the country, Harris representatives met to discuss plans, introduce new products and exchange ideas with company officials.

Welding extends three stacks

When three smoke stacks at Duquesne Light Co.'s Elrama Power Station had to be heightened by 60 ft to clear the top of a proposed building nearby, welding was used to erect the first stack in a fast 19 days. Although the original 67-ft. stacks were riveted, welding was chosen for the extensions. Three sections—8 ft high by 15 ft long and ¼ in. thick—comprise each ring. Each plate weighs 1,350 lb.

Eisenhower dedicates atomic power station

The world's first full-scale central station atomic power plant devoted to civilian uses was recently dedicated by President Eisenhower from Washington. The station is in Shippingport, Pa. Named the Shippingport Atomic Power Station, the $72,500,000 atom plant was started in Sept., 1954.

Southwest sales center for Milwaukee firm

Ampco Metal, Inc., Milwaukee, recently dedicated its new $250,000 foundry and sales center in Garland, Texas, which will serve the Southwest.

ONE of the 8-ft high, 1,350 ft. sections being lifted into place at Duquesne Light Co., Elrama, Pa. Three stacks—originally riveted—were extended 60 ft by welding. *(See story)*

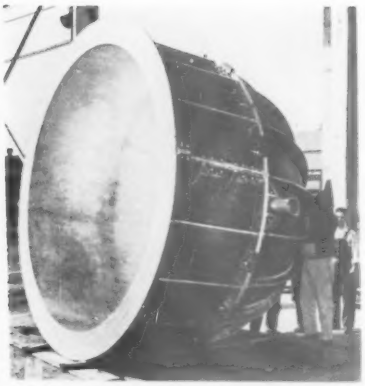
Shop welding saves on Tennessee fieldhouse

Time and money were saved by fabricating seven of nine sections of the new University of Tennessee field house in the shop, reports Hobart Brothers Co. Then each rigid frame was assembled, welded and X-rayed on the ground, and erected as a unit. "For speed in erection and strength in joints, we used arc welding to join sections of 208 ft long rigid frames for the fieldhouse," says W. E. Smiddy, erection superintendent for Crane and Truck Service, Alcoa, Tenn.

After the sections were joined and X-rayed, the 57½ ton rigid frame unit was lifted into place by four 30-ton motor cranes. Roof frame of the clear-span structure has no trusses or bracing. Building framework is 220 ft long, 203 ft wide and at center is 64 ft. It will have 7,000 permanent and 3,000 temporary seats.

Bulk of the welding was done at the shops of Tucker Steel Corp., Knoxville. Six welding operators used over 2¼ tons of electrodes on field splices. Current was supplied by six 300-amp portable gasoline engine-driven welders.

SKELETON of University of Tennessee's new field house shows welded rigid frames, which were assembled, welded and X-rayed on ground. *(See story)*



WELDED, 10-ft diameter aluminum mold will be used for molding resin-impregnated fibreglass radomes, Chicago Bridge & Iron Co. reports.

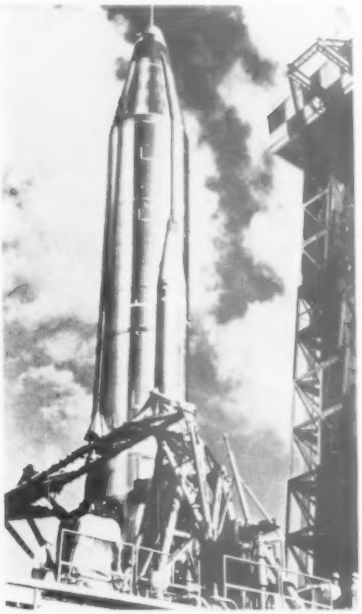
New $1 million plant to produce molybdenum

Coldwater, Mich., is the site of a new $1 million plant for the production of molybdenum metal and molybdenum-base alloys. It will be owned and operated by Climax Molybdenum Co. of Michigan, a wholly-owned subsidiary of American Metal Climax Co., New York. The plant is scheduled to go into production the latter part of 1958.

Equipment will include two vacuum arc consumable electrode melting furnaces, developed for molybdenum metal production. The plant will have capacity to produce more than 200,000 lb of castings annually and will employ about 50 persons.

Reveal Atlas missile is stainless steel

First details on the large use of stainless steel in intercontinental ballistic missiles was recently released by the Air Force. Except for the huge welded missile's warhead, which detaches after rocket burnout, the entire protective skin of the missile is made of the iron, nickel and chromium alloy. For its lightweight structure, the same skin is used in the walls of the propellant tanks. Welding specifications on the Atlas are restricted for at least six months, *WE* was told.



THIS country's first intercontinental ballastic missile, the Atlas, is almost entirely made of stainless steel, it was recently learned. Information on welding specifications is restricted for at least six months. *(See story)*

International contest on oxyacetylene flame

Papers dealing with one or more practical applications of the oxyacetylene flame may be entered in the Commission Permanente Internationale's Third International Competition. Open from Jan. 1 to Dec. 31, 1959, the competition promotes carbide and acetylene. Prizes will go to the best papers.

The CPI headquarters in Paris, France. For a copy of the regulations, write the Secretary, International Acetylene Association, 205 E. 42nd St., New York 17, N.Y.

Resistance welding firm locates in Philadelphia

A new corporation specializing in new and rebuilt resistance welding equipment, supplies and service and in new and rebuilt metalworking tools has been formed in Philadelphia. Named American-Hochman Welder and Machinery Corp., the new firm was organized by American Industrial Equipment Co. of Union City, N. J. and Ralph Hochman & Co., Newark, N. J. John R. Suplee will manage the new firm.

Hand welder may change packaging

A hand-operated aluminum foil welder ". . . may revolutionize both the packaging and electrical industries," according to Dr. Leslie K. Gulton, president of Gulton Industries, Inc., Metuchen, N. J. Aluminum foil, a widely-used packaging material, can be welded in continuous seams with the new lightweight welder. It

(Continued on page 70)

TAKING Lincoln Electric's nine-week welding course in Cleveland were these weldors from Iceland. Left to right: Thormar Gudjonsson, Thorir Gudjonsson, Gudhundur Gudmundsson, Fridrik Sigurbjornsson, Sverrir Olsen and Eirirkur Gudmundsson. Lincoln instructor Fred Klein briefs them on the latest arc welding techniques.

GULTON Industries' employees demonstrate welding airtight seals on aluminum-foil-wrapped food packages by using high frequency sound vibrations. Welder can be used on automated production lines or manually. Development marks first time aluminum foil can be welded in continuous seams, firm says. *(See story)*

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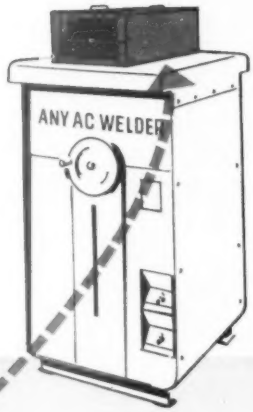

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brazed successfully with

Millers Falls Router Bits and Dyno-Mite high-speed power bits are revolutionary in concept, design and materials. They both perform with such unmatched efficiency that they have reached the "top-of-the-list" in their field.

Dependable, prolonged service is a "must" for all Millers Falls products and the component parts of both bits are therefore brazed with Silvaloy. The joints are as strong as the high-speed steels they join. Millers Falls uses Silvaloy 45 and Deoxo flux for these operations.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance. ★

SILVALOY
LOW TEMPERATURE SILVER BRAZING ALLOY

The Millers Falls Company is a leading manufacturer of quality hand and power tools for home and industry for over 90 years.

MILLERS FALLS TOOLS
SINCE 1868

AMERICAN PLATINUM & SILVER DIVISION

ENGELHARD INDUSTRIES, INC.

EXECUTIVE OFFICES:

113 ASTOR STREET • NEWARK 2, NEW JERSEY

THE SILVALOY DISTRIBUTORS

A.B.C. METALS CORPORATION
DENVER, COLORADO

BURDETT OXYGEN COMPANY
CLEVELAND • CINCINNATI
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NASHUA, NEW HAMPSHIRE

NOTTINGHAM STEEL & ALUMINUM CO.
CLEVELAND, OHIO

OLIVER H. VAN HORN CO., INC.
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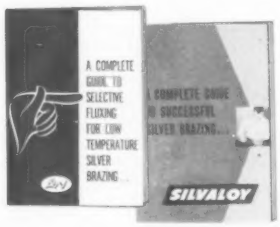
LICENSED CANADIAN MANUFACTURER
ENGELHARD INDUSTRIES OF CANADA, LTD. • TORONTO • MONTREAL



Two complete reference manuals for low-temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★ ★ ★ ★

JULY
1958

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.

. . Airline Welding & Engineering, Hawthorne, Calif., has been awarded $65,000 base contract by Lockheed Aircraft Corp. for "revolutionary" production welding machine. Airline also received supplementary engineering consultation contract.

. . Budd Co. and Navy Bureau of Aeronautics are working on welded metal sandwich structure for missiles and high-speed aircraft. New Budd-developed technique makes possible use of many materials, including stainless, which can be made in different shapes and sizes.

. . Steel production is making comeback. Scrap prices went up as much as $5 a ton last month, and steel mills should have hiked prices by the time you read this. Wage increase was due July 1.

. . Second largest aluminum reduction plant has gone into operation. Between Clarington and Hannibal, Ohio, new Ormet Corp. facility has annual capacity of 180,000 tons of primary aluminum. (Ormet is owned by Olin Mathieson and Revere Copper & Brass.)

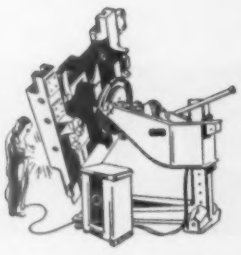
. . Welding wire is one of forms available in new nickel-base, high-temperature alloy known as "Rene 41," produced by Cannon-Muskegon Corp., Muskegon, Mich. In sheet form, its tensile strength is 180,000 psi at 1,000 F; 40,000 psi at 1,800 F.

. . Linde Co. will build plant for production of liquid oxygen and liquid nitrogen in Pittsburg, Calif. Site was chosen because of proximity to missile and rocket testing and operational facilities. Capacity: 300 tons daily.

. . Air Reduction Co. and Union Carbide Corp. were recent recipients of certificates of achievement (for safety) from Manufacturing Chemists' Association.

. . Most experts view latter half of year with optimism, expecting modest recovery within next few months. In addition to brighter steel picture, construction, automotive and aircraft industries are picking up, though some weak spots remain.

. . New chemical means of vapor coating metals with molybdenum has been developed by Climax Molybdenum Co. Process will give other metals moly's corrosion and wear resistance where it would be impractical to use solid molybdenum. Desirable properties of materials on which it is applied are also retained.



. . U. S. Steel will enter aluminum-coated steel sheet market. Firm's Irvin Works near Dravosburg, Pa., will produce sheets 18-gage and lighter after slight modification of its galvanizing line, which will enable operators to convert line from zinc to aluminum coating—and vice versa—in several hours.

If you use cutting

Big News

How Engineered Oxygen Cutting Can Increase Your Profits

A new concept in cutting machine techniques may revolutionize your thinking on what can be accomplished by oxygen cutting equipment. Messer cutting machines feature a distinctive design and construction.

For Greater Accuracy

Through a completely engineered system of operation, you can now achieve new standards of accuracy in precision workmanship! This means improved production efficiency in many industries where metal-working is involved. Messer machines can SAVE YOU MANY DOLLARS.

Revolutionary Design

Relatively new in the U.S.A., Messer is the acknowledged leader in cutting machine

Messer

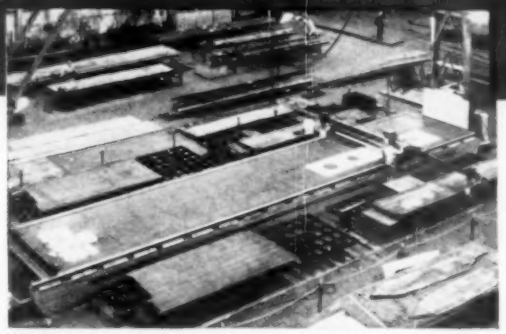
Messer Cutting

machines, here's

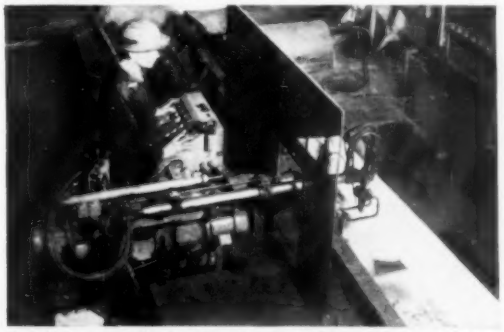
For YOU!

design throughout Europe and in other countries. Now in America, Messer cutting machine versatility of design permits greater shop flexibility and the increased use of automation that leads to **greater profits.**

If you use—or could use—oxygen cutting machines—it will pay you to check now on what Messer can offer you. Write for full information. No obligation, of course. **MESSER CUTTING MACHINES, INC., Chrysler Building, 405 Lexington Avenue, New York 17, N. Y.** *Precision Cutting Machines—Oxygen, Nitrogen, Argon Plants.*



Unlimited plate area or complex cutting operations present no problems to Messer equipment.



Complete automation is a key feature of Messer cutting machines, as used in this steel mill.

Machines

This New **PLUG-IN** Welder Control

Lets You

ADD CONTROL FUNCTIONS AS YOU NEED THEM

A Wide Range of Plug-In Units Enables You to Add Components as Your Welding Jobs Change

HERE'S HOW YOU CHANGE YOUR BASIC CONTROL SIMPLY BY ADDING PLUG-IN UNITS

FOR WELDING MILD STEEL— BASIC CONTROL INCLUDES THESE PLUG-IN UNITS:

3B Timer
Relay Valve Control
Tube Firing Panel

FOR WELDING ALUMINUM— YOU ALREADY HAVE:

3B Timer
Relay Valve Control
Tube Firing Panel

YOU ADD THESE PLUG-IN UNITS:

Heat Control
Up-down Slope
Forge Delay

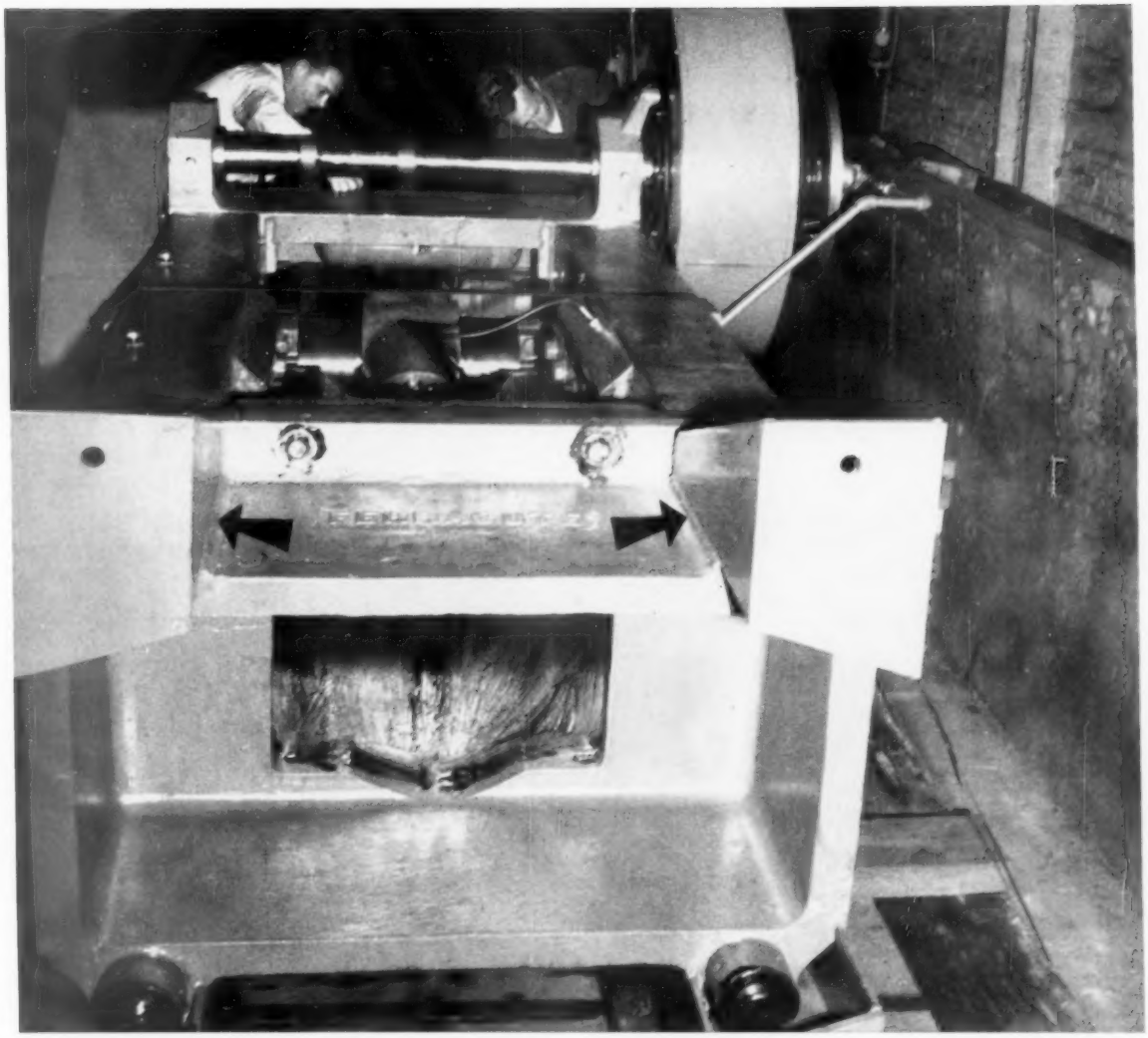
Every feature you want —for every welding job

- 22 standard units provide "custom" control for every welding requirement
- all units are plug-in type for quick change
- available in "all electronic" or "relay firing" versions
- auxiliaries for all conventional welding functions
- circuits include the latest safety features

Write **for Bulletin SM-277** to Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY



On its side, this 325 ton stamping press shows where fabricated steel legs are welded to the ductile iron base with Ni-Rod "55". Using ductile iron in head and bed, designer was able to drop press height two feet, and cut dead weight considerably.

Ductile iron welded to steel...with Ni-Rod "55" electrode ...supports 325 tons under impact

The bed of this stamping press is ductile iron. The legs are fabricated steel plate.

Weldors at the Ferracute Machine Company join these sections easily with Ni-Rod "55"* electrodes. Get a weld strong enough to support the entire weight of the press—325 tons—under impact!

They also use Ni-Rod "55" for head members—welding ductile iron to cast iron. Here again—excellent results. The high nickel content of this electrode fuses well with cast iron... builds up a sound, crack-free deposit. What's more, the weld area is soft enough for easy machining.

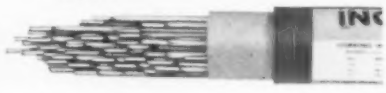
Inco booklet gives helpful tips on welding cast iron

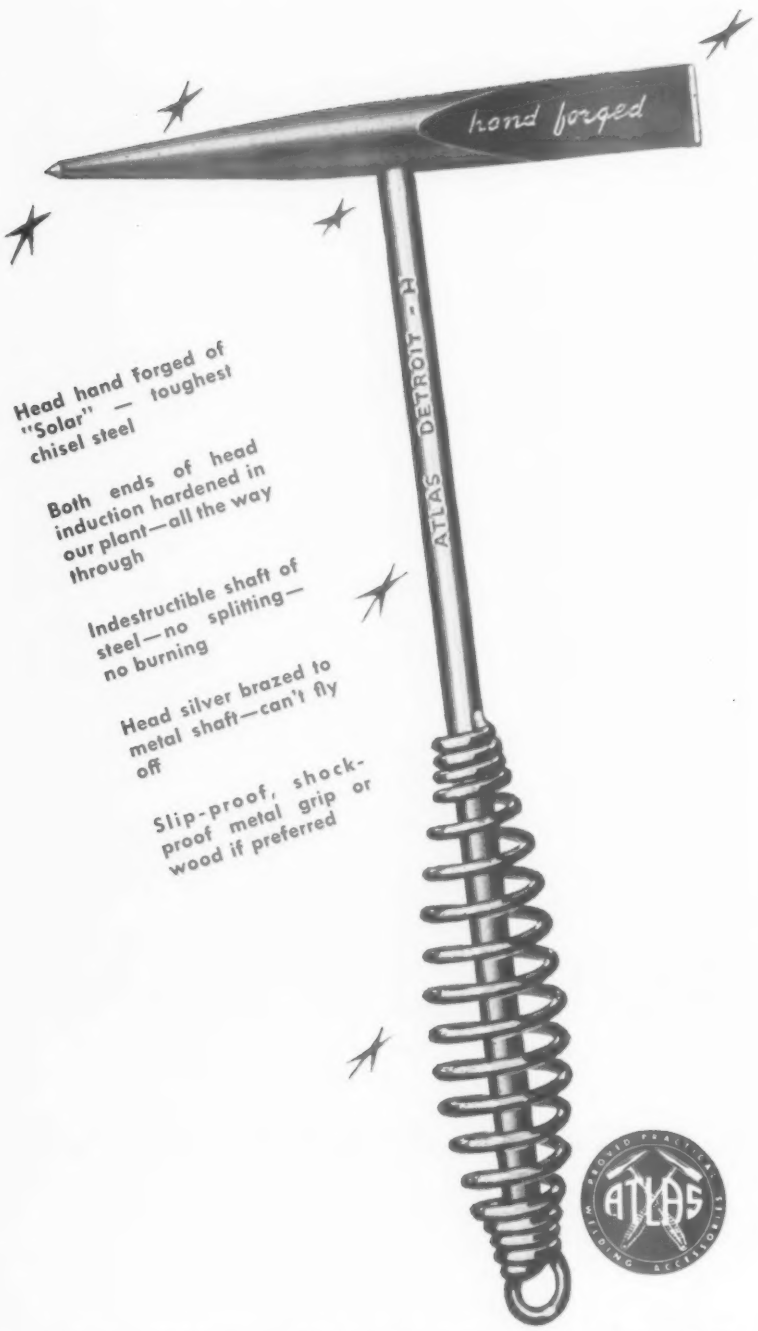
"A Handy Guide To Welding Cast Iron" covers the use of Ni-Rod "55" and Ni-Rod* for emergency repairs, production work, salvaging castings, repairing heavy sections and joining dissimilar ferrous metals. Booklet also gives complete technical data and tips on preparation. For your copy write:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street — New York 5, N. Y.

*Registered Trademark

INCO WELDING PRODUCTS
electrodes • wires • fluxes




hand forged
ATLAS DETROIT - H
Head hand forged of "Solar" — toughest chisel steel
Both ends of head induction hardened in our plant—all the way through
Indestructible shaft of steel—no splitting—no burning
Head silver brazed to metal shaft—can't fly off
Slip-proof, shock-proof metal grip or wood if preferred
ATLAS

YOU CAN'T BEAT ATLAS TOMAHAWKS FOR QUALITY!

Ask your welding supply dealer to show you the Atlas line of weld cleaning tools. Whatever the nature of your job there's an Atlas tool designed for it. Welders like them, their balance and feel and get better production with them.

ATLAS WELDING ACCESSORIES INC.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letters . . .

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Flaming tresses?

Sir: *Seattle*

Re: Your May Issue of WELDING ENGINEER, page 7 (*Female engineers take to the torch*). The photo shows two lovely weldorettes learning the fundamentals of our profession. Please note they are operating without the benefit of head covering to protect those lovely tresses from fire.

Might I suggest that some live wire welding supply house call on Bradley University and sell them some safety equipment to protect future female students from a possible scalping by flame.

John J. Morris
Welders Supply Co.

Never without

Sir: *Chicago*

I have been receiving WELDING ENGINEER for a few years and I like it very much. I would never be without it. . .

Joseph Vlach
J&R Welding Service

Vacuum boxes

Sir: *Texas City, Texas*

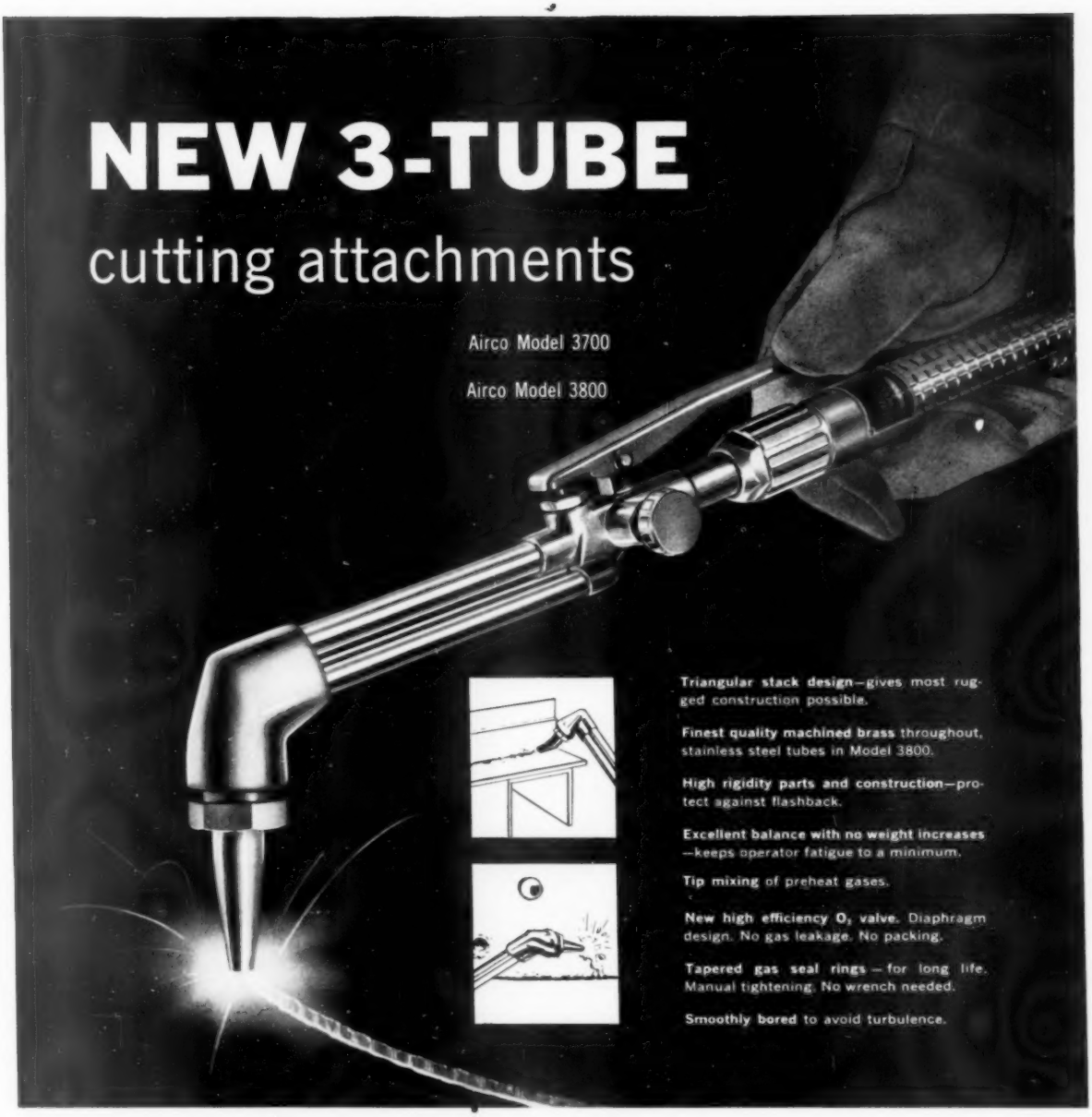
Please refer to page 62 of your May, 1958 issue of WELDING ENGINEER, stating that you know of no manufacturer of vacuum boxes. American Pipe & Steel Co., Alhambra, Calif., manufactures a vacuum box for weld testing. It is "American Seam Tester No. A-100" with a cast aluminum box. The operation is simplified and there are no interfering projections, if the gage is mounted inside to read external pressure and the inlet air is from the discharge of the compressor. The one and only $\frac{3}{8}$ in. plug valve is installed ahead of a $\frac{3}{8}$ in. tee with the other end of the run open to atmosphere. The branch of the tee is connected to the vacuum box. This is such a good ejector that the air ahead of the plug valve must be throttled to prevent breaking the wire reinforced glass. When the air is shut off the vacuum in the box automatically relieves itself.

B. F. Babin,
plant manager
American Oil Co.

NEW 3-TUBE
cutting attachments

Airco Model 3700

Airco Model 3800



Triangular stack design—gives most rugged construction possible.

Finest quality machined brass throughout, stainless steel tubes in Model 3800.

High rigidity parts and construction—protect against flashback.

Excellent balance with no weight increases—keeps operator fatigue to a minimum.

Tip mixing of preheat gases.

New high efficiency O_2 valve. Diaphragm design. No gas leakage. No packing.

Tapered gas seal rings — for long life. Manual tightening. No wrench needed.

Smoothly bored to avoid turbulence.

No. 3700 fits Airco No. 700 welding torch—cuts up to 4" steel, and Airco No. 750 welding torch—cuts up to 6" steel.

No. 3800 fits Airco No. 800 welding torch. Cuts up to 8" steel.

The finest available . . . Airco's 3-tube cutting attachments are fully adaptable to the widely used Airco welding torches. Both attachments take practically all Airco ¾" seat tips.

Before buying your next cutting attachment send to Airco for literature on these rugged new precision tools. Or, look in the yellow pages of the phone book under "Welding Equipment" for the Airco office or Airco Authorized Dealer nearest you.

AIRCO

Offices and dealers in most principal cities

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast —
Air Reduction Pacific Company

Internationally —
Airco Company International

In Cuba —
Cuban Air Products Corporation

In Canada —
Air Reduction Canada Limited

All divisions or subsidiaries of Air Reduction Company, Inc.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO — industrial gases, welding and cutting equipment, vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • PURECO — carbon dioxide — gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • OHIO — medical gases and hospital equipment • NATIONAL CARBIDE — pipeline acetylene and calcium carbide • COLTON — polyvinyl acetate, alcohols, and other synthetic resins.

Welding Wire: Cost-saving

• Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus better performance of the finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves our customers time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by nearby PAGE warehouse stocks, help make it economical and profitable for you to standardize on PAGE Welding Wire.

PAGE offers—
33 ANALYSES
...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc ...inert gas...tungsten or metal arc...oxy-acetylene gas welding.

For example—

ANALYSIS A-S-30 • With CO_2 gas shielded welding, it is essential that all gas and gas forming oxides be released from the melted base metal and the filler metal or welding wire while they are in the molten state. This is accomplished by having "Deoxidizers" in the welding wire. Usually these "Deoxidizers" consist of high manganese or silicon, but *Page A-S-30* goes even further by adding up to .75% of aluminum, which is the best "Deoxidizer" of all.

When a very "dirty" steel is welded with *Page-A-S-30*, the aluminum, along with the high silicon and manganese, produces a scrubbing action which liberates all gaseous impurities while the steel is still molten, allowing them to escape to the atmosphere and resulting in weld metal free of porosity, much cleaner but with the same high physical properties as are found in ordinary clean steel welded with a .60 Silicon, 1.00 Manganese wire as usually used. Well worth the slightly higher cost...Try *A-S-30* on hard-to-weld steel.

For example—

ANALYSIS A-S-NAX-9115 • This is a patented Low Alloy welding wire in which the alloying elements are approximately .60% Chromium and .10% Zirconium. It is designed for use with inert gas (Argon, helium, or CO_2), submerged arc (neutral flux), or acetylene gas (slightly reducing flame). The Chromium content gives it higher tensile strength and hardness and the Zirconium gives it a fine grain structure, toughness and obviates porosity.

It is the *only* welding wire to use on the popular NAX line of steel plates or castings which are noted for maintaining their strengths at elevated temperatures up to 1000°F.; but has peculiar virtues in welding points of SAE-1035 to 1045 carbon steels. Many job welding shops keep a stock of NAX-9115 welding wire on hand for whenever they encounter "dirty" steel or a job that resists welding with ordinary wire.

Write for—Welding Wire **Comparison Chart DH-1218** (*shown above*). This highly informative four-page chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Also shows uses and physical properties, including: tensile strength, elongation, Rockwell hardness. Chart lists virtually all competitive makes.

Write for—Submerged arc and inert gas welding wire **Folder DH-402A**...also gas welding rod **Booklet DH-1277.**

This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects...and insuring trouble-free, economical, profitable operation.

and Profit Factors

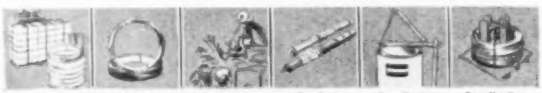
PAGE offers— Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. **Paper Wrapped Coils** 2. **Coils in Cartons, Palletized**
3. **Bare Coils (packed in Leverpaks)**
4. **Masonite Reels** 5. **Payoffpaks** 6. **Payoffpallets**
7. **Gas Rods in Burlap-wrapped Bundles**
8. **Stainless Gas Rods in 10-lb. Tubes**

For example— PAYOFFPAKS

Up to 700 lbs. of wire, without a single weld...coiled around a fiberboard cylinder within a fiberboard drum ...ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoffpaks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).



Wrapped Coils — Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want	Gas-shielded consumable electrodes		Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire	
PAGE WIRE for ▶ PACKAGING ▼	Automatic Welding	Semi-Automatic Welding			Manual Electric Welding	Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✔	✔	✔	✔		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✔	✔	✔	✔		
120 or 180 lb. (22"/24" I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✔			✔		
Special coil sizes (on application).	✔	✔	✔	✔		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✔	✔	✔	✔		
Leverpaks, 15" dia., 25-lb. coils (12" I.D.x2½" wide); Leverpaks, 17" dia. 50/60-lb. coils (13" I.D.x4" wide)	✔	✔	✔	✔		
Payoffpaks: 20" dia. size holds up to 500 lbs.; 23" dia. size holds up to 700 lbs.	✔	✔		✔		
Payoffpallets, holding 900-1200 lbs. of wire (⅛" to ⅛" sizes, incl.) coiled around pedestal on a wooden pallet.				✔		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36" lengths.			✔			✔
Fibreboard cartons, containing 10 lbs. of rods in 36" lengths; single or boxed. 50s and over.			✔			✔
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14" and 18" lengths.			✔		✔	

Write for—PAGE Welding Wire Packaging Chart

This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

Now—about Delivery... PAGE offers— Availability from local stocks

• Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

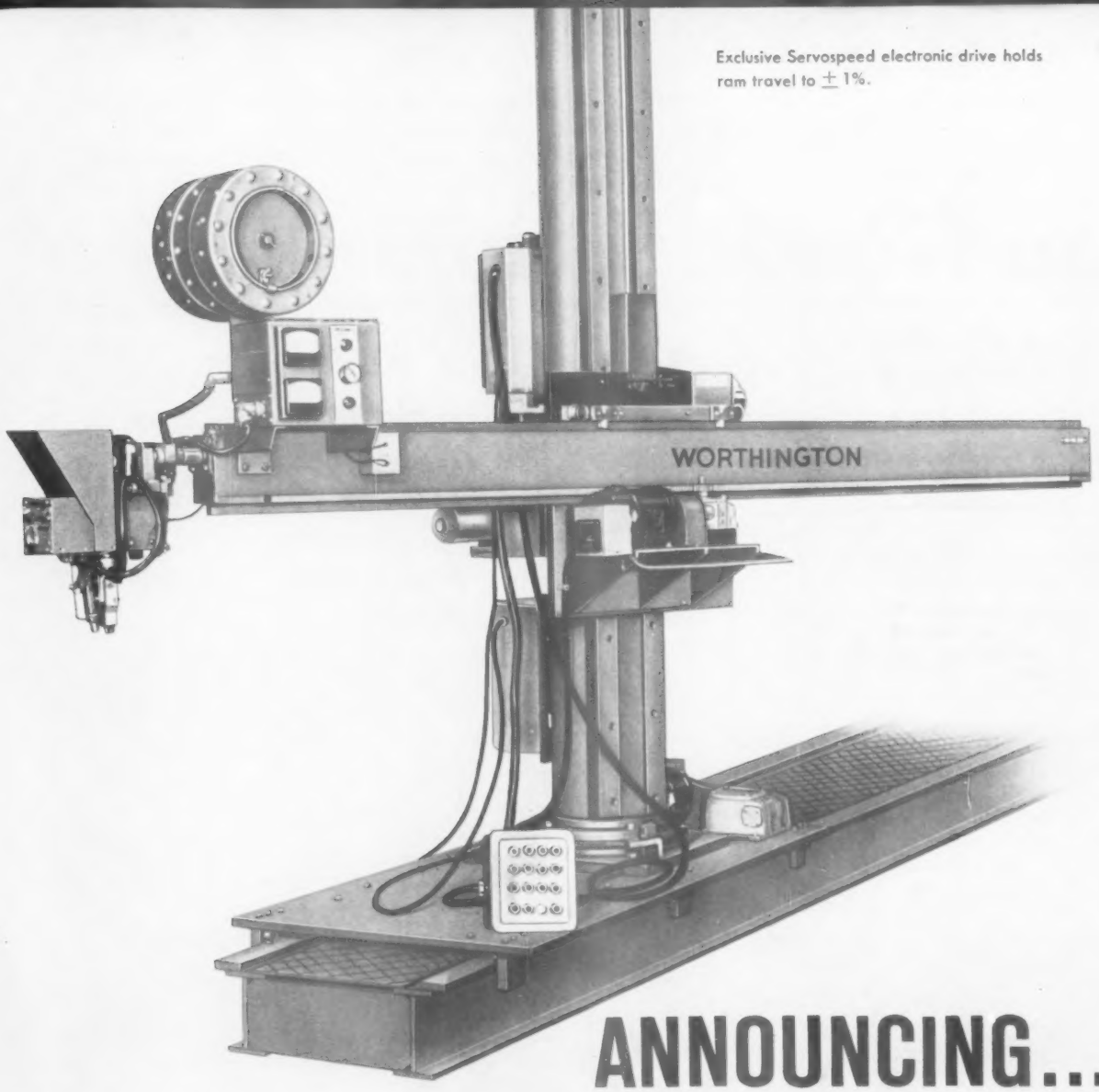
ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

ACCO for Better Values



Exclusive Servospeed electronic drive holds ram travel to ± 1%.

ANNOUNCING...

NEW AUTOMATIC WELDING HEAD MANIPULATOR three times more accurate!

Worthington has specially designed a series of welding head manipulators to meet the most stringent automation requirements.

This new line is available in sizes from 6′ x 6′ to 12′ x 12′. And each manipulator is equipped with the Servospeed electronic drive, far and away the most accurate of all electronic drives. It will control ram and carriage travel to ± 1% of set speed. (Up to now you've had to be satisfied with a spread of 6% or more!)

PLUS:

Rigid construction: mast of heavy tubular steel; ram is a fabricated steel box section, with precision machined ways for accurate travel.

Adjustable roller clusters grip 3 ways—assure a rigid ram with practically no deflection!

Positive drive carriage with adjustable limit switches on track.

Full 360 degree rotation: positive lock clamps mast in any position.

Wide speed range: from 3.47 to 149 inches per minute.

Brake motor for vertical travel for better control, more accuracy. Allows minor vertical changes to be easily made.

Write today for the detailed bulletin on these new manipulators, built in the world-famous Worthington tradition: precisely engineered for accuracy, completely tested for safety, and constructed to give years of steady, trouble-free service. Worthington Corporation, Positioning Equipment Division, Section 55-3, Harrison, N. J.

WORTHINGTON

BETWEEN PASSES

where's welding?

The venerable New York *Times* has a slogan well known in the journalistic field—"All the news fit to print." Well, we think the *Times* goofed and disregarded its own watchword recently in reporting on construction of its new subsidiary printing plant on Manhattan's west side. Seems the steelwork for the new edifice is being bolted, and in describing the job, the *Times* wrote, "The bolting process, which is about seven years old, is said to have advantages over riveting, including increased strength . . ." The news story contained another comparison between only these two joining methods. *Not one word about welding*, which certainly belongs in any article on steel construction. Its exclusion leaves the impression that only riveting and bolting are acceptable to architects and engineers—which is far from fact.

This is just another example of the general public's ignorance about the importance of welding . . . and why we all should do our damnedest to promote National Welded Products Month.

Remember September!

on the other hand . . .

Is it just our imagination, or have we been noticing more references to welding in consumer advertising? Within the past several weeks, we've seen at least four examples of newspaper advertisements in which the copy made specific note of the "electrically welded" or "all-welded" features. We hope this trend continues.

nickel tariff

At The International Nickel Co.'s recent annual meeting, Inco president Dr. John F. Thompson, in discussing U. S. tariff on nickel pointed out that "the United States government levies a duty of 1¼ cents per pound on refined nickel imported . . . but the duty does not apply to nickel oxide or nickel in such partially refined forms as slurry or matte. Nickel is not mined in important amounts in the U. S., and it has to import . . . from Canada and Cuba. Imports from Canada are principally in the form of fully refined metallic nickel, but imports from Cuba *(Ed. note: primarily from the U. S. government-owned Nicaro plant)* are now, and in the future are expected to be, in form of nickel oxide or partially refined nickel, a substantial part of which will be further refined into metallic nickel in the U. S. Effect of the duty is to favor Cuban nickel by imposing 1¼ cents per pound burden on Canadian metallic nickel. It is to be hoped that the U. S. will forego unnecessary tariffs on nickel and other metals, particularly on nickel, where the tariff effectively discriminates against Canadian production, which is by far the largest source of United States supply."

abrasives society

An annual national abrasives conference is being planned by the comparatively young American Society for Abrasives, so it looks like *WE* will have another meeting to cover editorially. The ASA's eighth chapter (on Long Island, N. Y.) was recently organized, and several more are in the formative stage. The society was founded to obtain and disseminate information on manufacture and use of abrasives. Membership is open to all persons "who have direct interests in the manufacture or use of abrasives and who are interested in furthering the science and art of the utilization of abrasives." If you're interested, write Jan Deelman, Secretary, American Society for Abrasives, 222 Berks County Trust Building, Reading, Pa.

bonus

Patent awards of $1,500 each have been presented by Westinghouse Electric Corp. to six employees responsible for developing the "West-ing-arc" welding system. The inventors are Harry J. Bichsel, George H. Cotter and Joseph F. Miller, all of the welding department in Buffalo; Alfred Baeslack of the systems control department, also in Buffalo; and Howard Ludwig and Julius Heuschkel, of research laboratories in Pittsburgh. The six men have a group record that includes 94 individual or joint disclosures which have resulted in 20 patents and 20 other active patent applications.

competition

Stateside welding equipment and electrode manufacturers have been receiving some pretty high-echelon competition from overseas in the person of D. J. W. Boag, managing director of Rockweld Ltd., England. Boag recently arrived in this country for the "purpose of boosting sales of his firm's welding equipment in the United States and Canada." Also, according to the news *WE* received, he "is not deterred by the current recession in North America. Since Rockweld products are comparatively inexpensive, they should appeal to cost-conscious Americans."

call for catalogs

The Defense Department is now compiling a "Directory of welding, heat-cutting and metallizing equipment" and needs help from such manufacturers. All catalogs—old and new—should be sent to: *Staff Director for Cataloging, Office of Asst. Sec. of Defense (Supply & Logistics) Attn: SC-72, Temporary Bldg. X, 19th & E. Capitol Sts. NE, Washington 25, D. C.* Since the directory will list all existing equipment regardless of age, you should send every catalog you've ever published

next month . . .

WE will bring you the first in a new series on "Fundamentals of welding engineering." The August issue will also include several top-notch articles on brazing.

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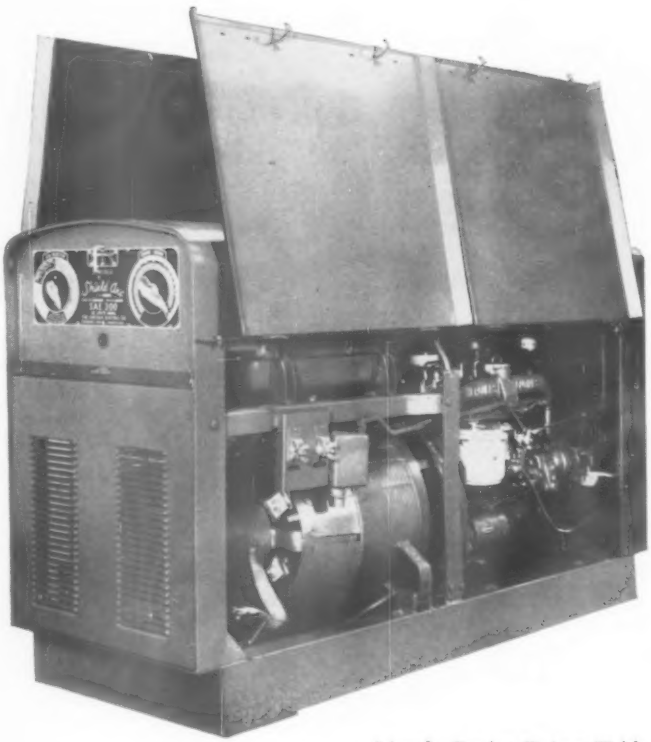

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JULY, 1958

Welding Engineer

ESTABLISHED 1916

Freedom needs your attention

JULY HAS ALWAYS had a special meaning for us . . . it's one of our favorite months. September, of course, is "National Welded Products Month," but July still tops them all.

It was in a July 182 years ago that our forefathers declared this a free nation. On that Fourth of July, 1776, we were given the right to do what we wanted, so long as we didn't endanger the life or property of others.

What did that freedom mean? It meant that the American citizen enjoyed the freedom of working at a job of his own choice . . . freedom from taxation without representation . . . freedom to take a chance on profit, or on going broke . . . the freedom to try out new ideas.

In short, we were given civil liberty. And with it came opportunities and incentives more favorable than any that have ever before existed in the world. Unfortunately, many of us who have "grown up" in this aura of freedom have not fully appreciated its value.

To Wendell Phillips is attributed the observation that "eternal vigilance is the price of liberty." But how many of us today are truly vigilant . . . honestly and deeply interested in the preservation of our freedoms?

There are many persons in this country of ours who would deprive us of those freedoms. And unfortunately, some of them occupy positions of trust in our government.

MANY OF OUR REPRESENTATIVES sponsor actions that are contrary to the will of the people who elected them. Through these actions, our freedoms are gradually snuffed-out. And though we protest, our protests go unheeded.

Take, for instance, our supposed freedom from taxation without representation. The desire to possess such a freedom was actually one of the basic reasons why our early leaders decided to strike out on their own. Yet today, we are all subjected to taxes more severe than any experienced by our forefathers. And, what is worse, a preponderance of the tax dollar is earmarked for purposes in which we have no representation.

To pay all the taxes he is subject to, the average U. S. employee worked to the middle of May. He can now use earnings for the remaining 7½ months to cover astronomical food, clothing, rent and medical expenses.

And it isn't only John Doe who suffers; the entrepreneur, too, is well aware that oppressive taxes are killing incentive. People wonder why they should bother to initiate their own businesses. They wonder why they should risk their savings when their "partner" who risks nothing —the tax collector—will take 30% of the first dollar profit they earn.

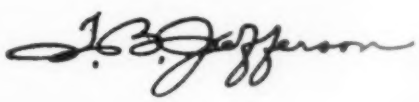
THIS IS THE UGLY situation which makes the adventuresome, pioneering spirit that built America seem hardly worthwhile nowadays.

We all know that human efforts are motivated, at least in a business sense, by the hope of reward or the fear of reversal. America's economic progress, fortunately, has been built on conditions that provide maximum opportunity for reward.

Under our free competitive system, entailing personal responsibilities and voluntary cooperation, our production of useful goods and services has outstripped that of any other nation. Yet, there are some who will tell you that free competition is ruthless and cruel . . . that we should have security even at the expense of freedom.

Security without freedom is offered in the totalitarian state, where initiative is encouraged by threats of internment, exile or death. In America, we can do without this motivation.

Freedom is our precious heritage. Let us guard it diligently—and see to it that our elected representatives do likewise. If each one of us could work as hard to maintan freedom as we do to improve our golf game, the things we cherish would never be endangered.



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MAINTENANCE

Maintenance . . . it's an ounce of prevention when possible, a pound of cure when necessary. But whether the job is large or small, welding makes your maintenance task *easier* . . . does the job *quicker* . . . saves you *money!*

Where can welded maintenance be employed? In every area where metal parts must be built up, repaired or replaced. This special Maintenance Issue covers the application of welding in five fields where it has become a valued, trustworthy repair and fabrication tool.

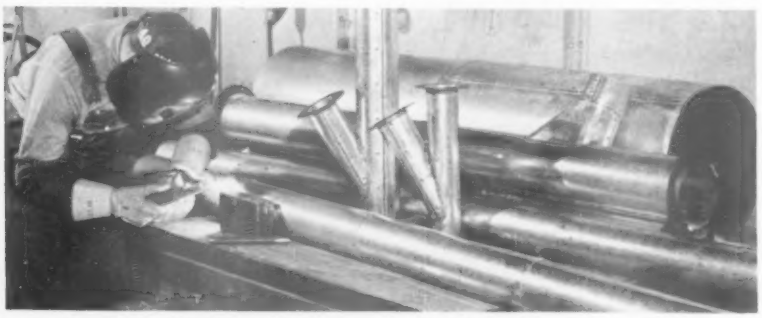
There are many other areas where welding is, or could be, equally valuable. We hope that the articles to follow may give non-users some tips on welding's versatility and vast potential. And perhaps they'll also help present users to spot further maintenance areas that demand welding's strength and economy.

Tig, gas, arc, et. al.:

This is MAINTENANCE *in a heavy industrial plant*

By Fel Tancula

TRACK shoe quench fixture is joined by Tig (tungsten inert-gas) process. Made from 10-gage 18-8 stainless, some parts of fixture are fabricated by manual metal arc. Operation depicted calls for argon shield, 2% thoriated-tungsten electrode, d-c straight polarity. 18-8 filler rod 3/32 in. in diameter.



HOOD and piping of 16-gage galvanized steel are fabricated with use of 3/32-in. coated aluminum-bronze electrode. Current is d-c reverse polarity. Electrode has good tensile strength, is fast, burns away little galvanizing at joint if low currents are used. After exhaustive testing, weld areas show no more corrosion than non-affected part of test plates.

DAMPER and transitions for exhaust are made by Maintenance from 12-gauge 316 stainless steel sheet. Caterpillar once tried 1020 carbon steel, but rejected it because of its inability to withstand scaling at elevated temperatures.

CONNECTING link on bridal chain is welded by oxyacetylene process. Rings 1 in. or thicker are arc welded.

IN A LARGE industrial plant, the word "maintenance" connotes more than maintaining—and repairing—production equipment and factory facilities.

Weldors at the Peoria, Ill., plant of Caterpillar Tractor Co., for example, fabricate a great number of accessory items like lifting chains, jigs, fixtures, exhausting systems and similar apparatus.

The maintenance department at Peoria normally comprises 21 weldors who work in the Central Shop. But the firm also employs other maintenance weldors who are members of teams located in strategic areas within Caterpillar's huge plant. Weldors on these smaller crews make minor repairs on the site only, while major repairs are made in the Central Shop.

Minor repairs include those made on pipelines, certain furnace elements and broken piece parts. *Major* repairs include broken presses, lathes, and similar large equipment that must be dismantled.

For the manufacture of its various lines of huge earthmoving equipment, Caterpillar must employ hundreds of lifting devices. Central Shop has built (and services) more

than 45,000 pieces of lifting equipment. These parts are used predominantly on shop cranes, some on conveyor systems.

The firm designs and builds its own lifting accessories (chains, frames, slings) because it is often impossible to buy the type of connecting links or hooks needed for its myriad jib and bridge cranes.

A typical fabrication job faced by weldors in the shop are the aforementioned links for lifting chains. Most master rings and connecting links less than 1-in. thick are welded with the oxyacetylene process, while heavier ones are arc welded. Links and rings for average use are made from 1020 carbon steel, while 8645 steel is reserved for those to be used with heavier loads.

In gas welding the 1020 links, a low-carbon filler rod with a tensile strength of 65,000 psi is used. For arc welding the same 1020 steel, E7010 electrodes are employed. Each maintenance weldor does his own chamfering and also anneals each link.

On the 8645 steel links, rods rated at 85,000 psi tensile strength are used in gas welding, and E9015 electrodes in arc welding. Links of this material are chamfered by the weldor, but are heat treated in a furnace after joining.

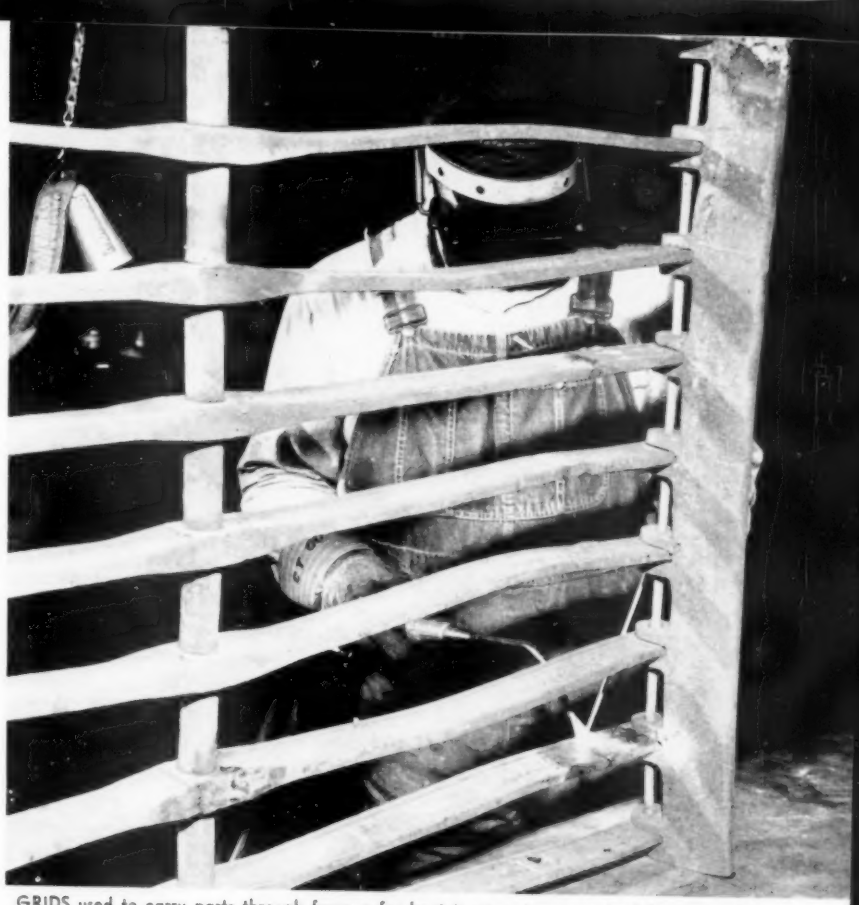
Weldors doing this type of work have to pass qualifications tests for both arc and gas processes semi-annually.

(All chain welds are identified by the weldor's individual stamp near the weld. This "signing" of his work makes every operator alert to his responsibility.)

Size of the links dictates gas pressures and diameter sizes of filler rods. When arc welding, a motor-generator power source, with amperage ranging from 200 to 400, is used exclusively.

According to D. L. Caldwell, who is in charge of Caterpillar's maintenance welding department, an average day finds "about 45 links fabricated by each of the three (sometimes four) weldors assigned this task in Central Shop."

The photographs on these pages depict joining tasks that are part of a typical day's work for a Caterpillar maintenance weldor—who must be master of many welding methods.



GRIDS used to carry parts through furnace for heat treatment are repaired by oxyacetylene method. Subjected to temperatures as high as 1,700 F, grids are 330 stainless but still connot withstand heating-cooling cycle indefinitely. Damaged areas are melted out, re-welded with 3/16-in. type 330 rod.

RACK for use in chrome plating small parts has steel frame with 3/16-in. lead sheathing. Where lead is joined to frame, steel must be thoroughly cleaned and tinned. Filler is 3/16-in. strips of sheet lead; heat is supplied with oxyacetylene torch. Later, three tubes, rolled from same lead sheet, are joined to frame.

where MAINTENANCE welding often entails production problems

By Jack Fairlie

IN THE WORLD of Herbert Henry Dow, brine was the stuff that dreams are made of."

This was the way Carl A. Gerstacker, Dow Chemical Co. vice president and treasurer, characterized the incentive that led Herbert Dow to found, in 1897, what is now the fourth largest U. S. chemical-producing firm.

Dow's headquarters installation stretches seemingly to the horizon over the prehistoric sea area that is now Midland, Mich. Beneath the flat and barren ground on which the plant stands are the raw materials which constitute most of Dow's 600-plus products.

WELDOR uses Tig process to join 1½-in. type 304 stainless pipe. Electrode is 3/32-in. thoriated tungsten, and filler rod is ⅛ in. in diameter. Argon at 12 cfh is the shielding gas, and a nitrogen back-up is used. Welding current of 200 amp d-c straight polarity is suppled by a 300-amp a-c/d-c high-frequency unit.

SEMIAUTOMATIC "DoAll" saw with bundling attachment is used to cut these 1¼-in. steel pipe nipples. Mechanical cutting is used at Dow when work can be done in quantity as it is here.

The containment of these materials—in a virgin state, during processing, or as finished products awaiting shipment—is the vital task assigned to a wide array of metals and to the process which joins them: *welding*.

Miles of piping are required to pump liquid chemicals to and from processing stations throughout the Midland plant. And to the lines already installed are constantly added new pipe lengths, as well as replacement sections.

To handle this diversified and never-ending job, Dow employs a welding force of approximately 160 men—each of whom has been thoroughly trained and qualified to perform his job under existing company procedures.

Though weldor training programs have always been viewed as important at Dow, it wasn't until 1952 that a formal and unified training system was definitely established. In the intervening years, 61 employees have successfully completed the course.

In order to qualify as a student for this intensive welding course, an applicant must already be an employee of Dow. He must bid for admission to the school and wait for an opening. Such restrictions naturally limit the weldor training groups to those who are sincerely interested in the long-term aspects of learning welding skills.

Once enrolled for welding classes, the student must set himself for a total of 294 hours of intensive and varied training—and for a 36-month appenticeship.

Here's a break-down of hours spent in learning the welding trade at Dow:

160 hours: manual metal-arc, oxyacetylene and Tig

MAINTENANCE worker in Dow pipe shop grinds a flange weld in preparation for "Heresite" lining. "Saran" plastic is also used extensively as a pipe lining material in the shop.

(tungsten inert-gas) welding application. Many classroom exercises in welding mild steel are included.

54 hours: welding theory. This portion of the student's training time is spread over a period of 24 months, and is therefore fortified by the practical experience then being gained by the apprentice weldor.

· **80 hours:** a study of weldable alloys, and the problems inherent in special welding applications—such as copper. Prerequisite for this portion of the welding course is the attainment of a journeyman's status by the weldor.

After 80 hours of his initial classroom schedule of 160, the new weldor is permitted to do some non-critical work under the guidance of a journeyman weldor. The range of allowable metal types on which he can work is increased when the 160-hour training segment comes to an end.

As an apprentice, the new weldor may be assigned either to the Dow pipe welding shop, or to the boiler shop in which tanks, pressure vessels and other containers of all types and sizes are fabricated and repaired.

In the pipe shop, weldors must devote their talents to the fabrication of a bewildering selection of metal types: stainless (both straight chrome and chrome-nickel: types 304, 309, 310, 316, 347, 430 and 446); nickel; Inconel; Monel; copper and aluminum (1100 and 6063). Weldors must also be proficient in the application of certain hardfacing materials—including those designed for use under high-temperature service conditions.

Dow's pipe shop weldors are classified as "maintenance workers"—a term derived from the fact that, though they may devote most of their time in any given week or month to new fabrications, the material produced is strictly for in-plant use.

The three welding processes (manual metal-arc, oxy-acetylene and Tig) which the student weldor studied and used during his initial 160-hour training period are the same three which he uses most often in his pipe shop work. The emphasis, of course, is upon manual metal-arc welding, though the other two methods are put to extensive use whenever critical metals, or small-diameter (2-in. or less) or copper pipe and tubing, must be welded.

Available as power sources for the pipe shop weldor are 200, 300, and 600-amp d-c rectifier machines. Whenever welding operations must be done in the field, weldors use engine or electric-drive motor-generator sets. (The electric-drive units are sealed at Dow because of the highly corrosive atmospheres in which they are sometimes operated. One m-g set, recently unsealed after 10 years of continual use, had the appearance of a new machine.)

Welds made by apprentice and journeymen weldors in the Dow pipe shop are subject to a variety of tests—all of the non-destructive type. Depending upon their size and intended use, weldments may be inspected by the magnetic-particle, dye-penetrant, hydrostatic, X-ray or gamma-ray test methods.

Individual weldors' samples are also tested in a program of spot-checking that reaches every one of the 160-man welding force at least once every six months.

What of the fire hazard which certainly exists when welded repairs are called for in an area where highly volatile chemicals are stored?

USING a hot air torch and 1/8-in. filler rod, this weldor joins a 1 1/2-in. pipe made of Dow's "Saran" plastic.

PENCIL coil bundle is hydrostatically tested at 300 psi. Testing unit is capable of providing pressures to 10,000 psi.

Ever alert to this potentially disastrous problem, Dow has thrown virtually insurmountable roadblocks into the path of TROUBLE.

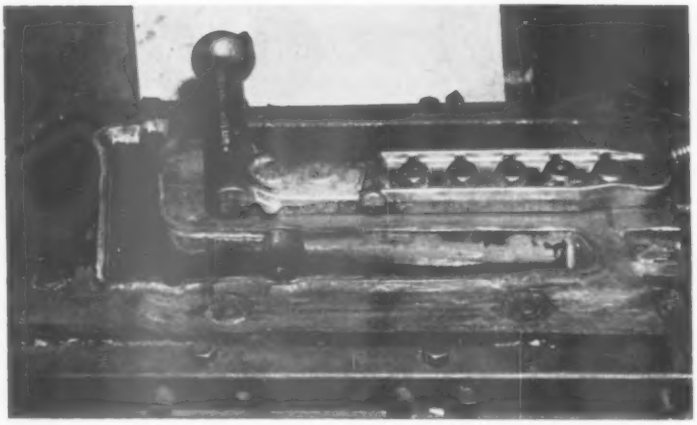
Like many another large manufacturer with flammable products, Dow requires each weldor to obtain a special work permit whenever he is called upon to work in any area outside of the pipe or boiler shop.

Secondly, the firm demands that every production supervisor check the area in which welding will be done—and the equipment that will be used there, as well. This inspection must then be double-checked by the weldors themselves.

Lastly, to further insure adequate fire prevention standards throughout its plant area, Dow encourages every weldor to evaluate the condition of welding equipment with which he works. The weldor who doubts the safety of a particular piece of apparatus knows that he is free to call immediately upon the firm's Safety Dept. for thorough inspection.

Dow Chemical Co. has obviously achieved its high-ranking competitive position among U. S. chemical producers more through inventive genius than through any other single factor.

But when the results of laboratory creativity begin to flow, welding—and the metals it joins—provides a reliable avenue through which chemical products are carried into the mainstream of U. S. commerce.



TWO examples of steel mill parts currently receiving long-life E3N12 applications are these hot forge trimmer dies. Both are subjected to 2,100-F temperatures. The one at left trims 50,000 parts between hardfacings; the one above will handle 20,000 pieces of 1045 steel in the same period.

Temperature's rising, so it isn't surprising that:

Steel mills look to E3N12's for high strength in high heat

THE HARDFACING ALLOYS made to withstand service conditions of impact, abrasion and corrosive or erosive media are plenty tough. But they *do* get a break on one score: they don't normally have to resist the effects of high temperatures into the bargain.

Heat-resistant hardfacing alloys are generally employed wherever normal operating temperatures exceed 1,000 F. Obviously, steel mill equipment is often subjected to just this type of service condition.

To find out how the popular E3N12 heat-resistant alloy has withstood the acid-test of steel mill usage, WELDING ENGINEER queried Haynes Stellite Co. of New York. Haynes' "Alloy C" corresponds to the AWS-ASTM E3N12 designation.

Produced as a coated electrode, the nickel-base E3N12 type contains molybdenum, iron, tungsten and chromium as principal alloying elements. Haynes reports that, with its low coefficient of friction, it is able to withstand effects of thermal shock. Further, it doesn't soften appreciably at elevated temperatures, and maintains a resistance to cracking or spalling when exposed to both impact and heat.

When the characteristics of high tensile strength, good ductility and high chip resistance are added to those stated above, it's obvious why this alloy is so extensively used.

As deposited, the E3N12 hardfacing material has a hardness of about 210 Brinell, and Haynes notes that in service, the deposit will work-harden without deformation to about 325 to 375 Brinell. Such a characteristic naturally precludes the use of peening or other mechanical methods to achieve maximum hardness.

Typical steel mill applications of E3N12, in which it has increased parts life 10 times or more, include blooming mill hot shear blades, entry and delivery guides, twist guide rolls, angular guides, dies and shafts.

Breaking down this list, here is what the E3N12 electrode is capable of doing:

On hot shear blades in blooming mills, the alloy is applied by the manual metal-arc process to a thickness of about 1/16 to 3/32 in. A blade preheat of approximately 400 F before alloy application is generally recommended. However, some hardfacing has been done without preheat with no apparent problems.

There have been no reports concerning the chipping or spalling of a properly applied E3N12 deposit, and the slight heat checks developed from time to time have not penetrated to base metal and are therefore harmless. A deposit of this alloy is said to wear very slowly, allowing the blade to operate at maximum efficiency until the cutting edge is rounded.

When an E3N12 deposit has worn out, Haynes recommends that users

of its own "C" brand employ only normal cleaning operations prior to resurfacing. The firm further advises the use of machining, rather than grinding, if an entire deposit should have to be removed.

Service life on blades? Statistics indicate that blades used in shearing 4-in. by 4-in. to 12 by 12-in. squares, or for shearing 2 by 24-in. up to 8 by 48-in. flats, outlast plain carbon or low-alloy blades 10 times.

One blooming mill, which wanted to determine for itself the relative merits of hardfaced and unsurfaced shear blades, and of a high-alloy cast electrode and the E3N12 type, subjected two blades to an extensive test. The blades contained 0.70% carbon.

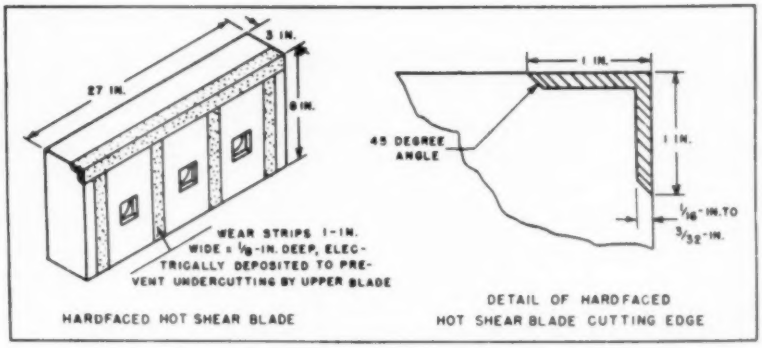
Unsurfaced, a blade edge normally lasted for six eight-hour shifts before losing its cutting ability. When hardfaced with the high-alloy electrode, it turned in a six-week performance (slightly more than 110 eight-hour shifts). During this time, however, it chipped badly and required extensive rebuilding. And with each rebuilding, deposit thickness increased at every rewelded section to cause more serious chipping.

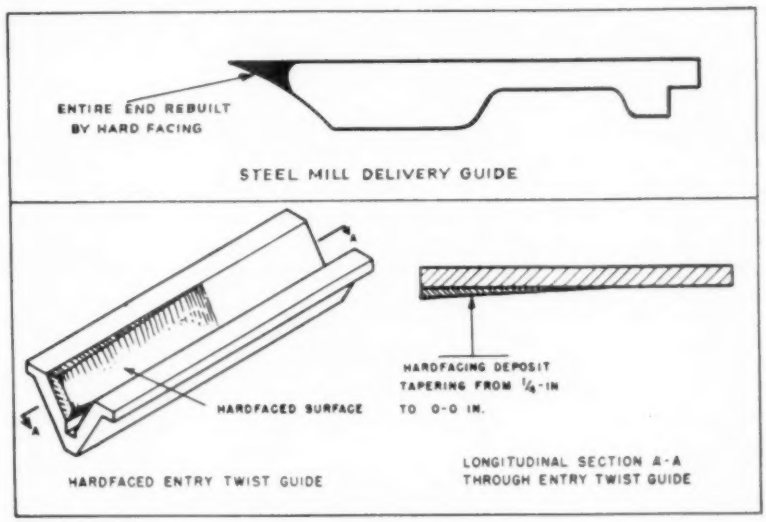
The blade hardfaced with E3N12 was installed simultaneously with that surfaced by the high-alloy type. When both were inspected at the end of six weeks, the E3N12 surfacing showed only fine checks but no chips—in contrast to its badly chipped counterpart. The mill estimated that the E3N12 alloy would have allowed blade operation through another 10 to 20 shifts.

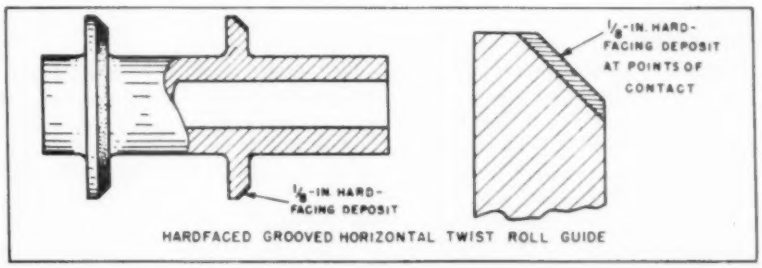
Entry and delivery guides, and especially the latter, provide a particularly critical testing ground for the E3N12 alloy. The material with which these guides are surfaced must be a type that will not mark the product in any way.

Though many potential users had convinced themselves that an E3N12 material won't chip when properly applied, Haynes Stellite reports, they still felt that the heat checks which admittedly developed would mar the hot steel. This opinion soon changed when it was indicated that the surfacing deposit was soft enough to allow sharp edges of the checks to round off immediately.

One steel mill reports that guides hardfaced with E3N12 last eight times as long as plain carbon or low-alloy steel types, and four times as long as high-alloy steel guides.


5 IN.
27 IN.
6 IN.
WEAR STRIPS 1-IN. WIDE x 1/8-IN. DEEP, ELECTRICALLY DEPOSITED TO PREVENT UNDERCUTTING BY UPPER BLADE
HARDFACED HOT SHEAR BLADE
1 IN.
45 DEGREE ANGLE
1 IN.
1/16-IN. TO 3/32-IN.
DETAIL OF HARDFACED HOT SHEAR BLADE CUTTING EDGE


ENTIRE END REBUILT BY HARD FACING
STEEL MILL DELIVERY GUIDE
HARDFACED SURFACE
HARDFACED ENTRY TWIST GUIDE
HARDFACING DEPOSIT TAPERING FROM 1/4-IN TO 0-0 IN.
LONGITUDINAL SECTION A-A THROUGH ENTRY TWIST GUIDE



A 24-in. Pennsylvania mill had entry guides hardfaced with Haynes' E3N12 electrode and rolled 15,000 tons of steel per week on 19 eight-hour shifts—five times more than tonnage rolled with unsurfaced guides.

Horizontal twist guide rolls have, on an average, lasted six times longer than ordinary steel rolls when hardfaced with the E3N12 alloy. Haynes reports an instance when the service life of 18-in.-diameter guides used for rolling 2-in. squares was increased four times over plain carbon steel castings and forgings by hardfacing with "Alloy C" electrodes.

The firm admits that original cost of hardfacing these guides with E3N12 was three times that of new rollers. But hardfacing's economy became evident when, having served for a period four times as long as that expected from unsurfaced rollers, the twist guides were once again hardfaced—this time at only twice the cost of new rollers. And, again, service life got a 400% boost.

Suppliers of chromium-molybdenum steels, and of filler metals for welding them, offer considerable literature on their chemistry and mechanical properties. Several determining factors in selection will be reviewed in this article. In the one to follow, the effect of preheat and postheat on their mechanical properties and usability characteristics will be covered.

Part I

Selection, welding of CrMo alloy steel pipe

By Jay Bland*

WELDING OF CHROMIUM-MOLYBDENUM alloy steel pipe is a broad subject, and numerous papers have discussed specific aspects of its weldability characteristics.

Generally, problems encountered in arc welding these alloy steel pipes increase in proportion to alloy content. Consequently, use of lower alloy steels is a decided advantage from a weldability viewpoint.

For convenience, various chromium-molybdenum alloy steels used for piping will be designated by their nominal chromium contents, *e.g.*: the 1¼% Cr—½% Mo alloy as 1¼ CrMo; the 2¼% Cr—1% Mo alloy as 2¼ CrMo, etc.

Any one or a combination of several factors may be the basis for selecting these alloy steels. Factors include the steel's resistance to graphitization, to high-temperature hydrogen attack, to oxidation or scaling, and to corrosion attack, as well as its higher strength at elevated temperatures.

Figure 1 contains three sketches of some typical microstructures of plain carbon steel magnified 1,000 times. In the left panel is the normalized structure in which carbon is present as an iron carbide compound in localized areas called pearlite. Some typical properties of this steel are indicated below the sketch.

The center sketch is the same steel after a prolonged period at elevated temperatures. Plates of iron carbide have become spheroidized—*i.e.* transformed into essentially round or slightly elongated spheroids, well dispersed through the structure of the background ferrite or iron. Properties indicate a noticeable reduction in tensile strength and significant improvement in ductility.

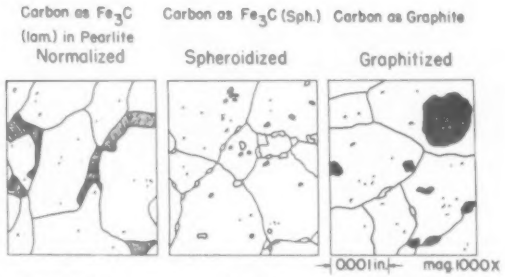

Carbon as Fe_3C (lam.) in Pearlite
Normalized
Carbon as Fe_3C (Sph.)
Spheroidized
Carbon as Graphite
Graphitized
.0001 in.
mag. 1000 X
Tensile PSI 69,000 53,000 49,000
Yield, PSI 47,000 35,000 33,000
% Elong. 37 44 44
% Red Area 66 73 73
0.26% C, 0.48% Mn, 0.27% Si, 0.007% P, 0.025% S

FIG. 1: Sketches of typical plain carbon steel structures showing changes due to high-temperature service and graphitization.

In the sketch at the right, carbon has been converted from an iron carbide compound to free carbon existing as graphite. The resulting effect on its properties is a further reduction in strength (from 5 to 10%) with no noticeable additional reduction in ductility as measured at room temperature.

This type of well-dispersed graphite is not particularly objectionable. Even at the reduced strength properties, steel used in vessels designed to code specifications are still well above any design stresses. Consequently, no disastrous failure would be expected. However, some failure of both plain carbon and carbon ½% Mo steel pipes have occurred.

Distribution of graphite in the vicinity of a weld is shown in Figure 2. In addition to the well-dispersed

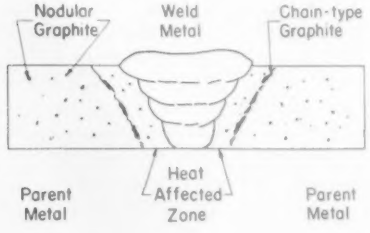


FIG. 2: Schematic distribution of graphite in vicinity of a weld. Particles are exaggerated in size.

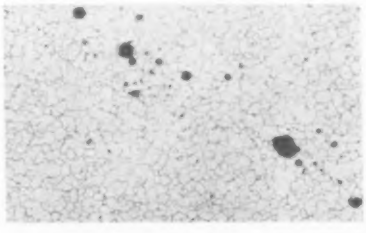


FIG. 3: Photomicrograph of plain carbon steel pipe showing decarburized structure with small amount of graphite.

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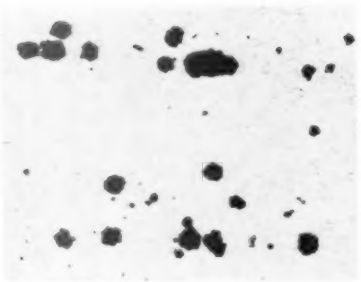


FIG. 4: Photomicrograph of plain carbon steel pipe showing decarburized structure and severe graphitization.

graphite in the base metal, there is a unique arrangement of graphite near the edge of the heat-affected zone. This type of graphite—termed *chain* or *eyebrow*—is particularly disastrous because it forms a plane of weakness extending through the full wall section. Graphitization of plain carbon steel deposits, however, is extremely rare.

Graphitization—accomplished by loss of carbide particles—results in an essentially pure iron structure. One theory holds that the process of graphitization involves precipitation of graphite at random sites, depleting the iron in dissolved carbon. Subsequently, the iron carbide particles dissolve in the iron to increase carbon content, which then redeposits at the site of the initially nucleated graphite particles.

Some typical structures actually found in refinery piping are shown in Figures 3 and 4. Plain carbon steel pipe, with a small amount of graphite at 100 times magnification, is shown in Figure 3. Figure 4 depicts a more severe case of graphitization.

In the latter figure, the number of graphite particles have aligned to some extent—though they still retain nodular or rounded forms. Again, there is almost a complete absence of carbide in the iron structure.

High-temperature hydrogen attack is a second factor which determines the selection of CrMo steels. In Figure 5, the steel structure has undergone two significant changes.

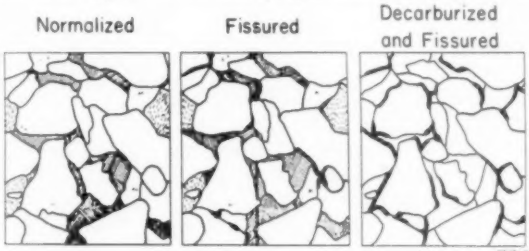
First there is an apparent decarburization—similar to the change during graphitization. Accompanying carbide loss is the formation of extremely small fissures or cracks at grain boundaries. These cracks are produced when hydrogen at high temperatures penetrates steel and reacts with carbides to form methane.

Since methane cannot diffuse through steel at these temperatures, extremely high aerostatic pressures are built, resulting in ruptures and fissures.

Pressure test data shows a marked reduction in strength for the hydrogen-charged vessel. Of greater significance is the fact that the fissures are internal notches, which readily progress into cracks.

Extensive failure of some refinery vessels during early 1956 was traced to this hydrogen attack. Material soundness had been questioned at first because the metal continued to crack during repair welding operations. But it was found that almost two-thirds of the vessel's wall thickness showed these small cracks.

Figures 6, 7 and 8 are typical photomicrographs of the structures found in hydrogen-embrittled steel. Figure 6 shows decarburization which precedes the fissuring, with a few fissures in the grain boundaries. Decarburization is not a continuous, uniform penetration from a surface, but will appear in various proportions at various levels.



PRESSURE TEST DATA on VESSEL CHARGED with HYDROGEN

	SOUND VESSEL	H_2 CHARGED VESSEL
YIELD	525 PSI	500 PSI
RUPTURE	1050 PSI	800 PSI

FIG. 5: Sketches of typical plain carbon steel structure showing changes due to high-temperature hydrogen attack.

An area almost completely decarburized with extensive fissuring at the grain boundaries is shown in Figure 7, while Figure 8—a high magnification of a typical fissured area—shows distribution of fissures around a single grain. Ductility of the material is greatly reduced by these internal cracks.

What can be done to select steel resistant to this deterioration? The chart in Figure 9 indicates safe limits for use of low-alloy steels and shows reactions involved in the fissuring process at the top of the chart. Selection

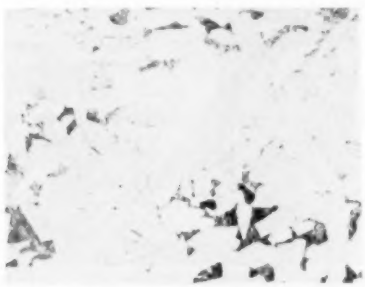


FIG. 6: Photomicrograph of plain carbon steel in initial stage of hydrogen attack; shows partial decarburization and some fissuring.

FIG. 7: Plain carbon steel completely embrittled by high temperature hydrogen attack with complete decarburization and fissuring.

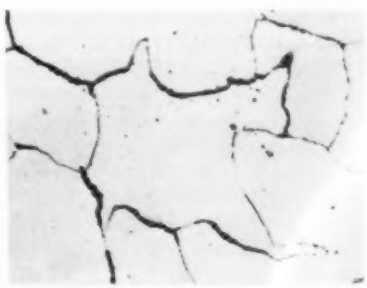


FIG. 8: Higher magnification of Figure 7. Note that grain is almost completely surrounded by fissures. Magnified 1,500 times.

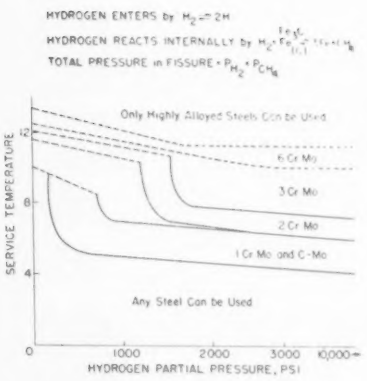


FIG. 9: Sketch of chart showing safe limits for use of various grades of steel in hydrogen service at high temperatures.

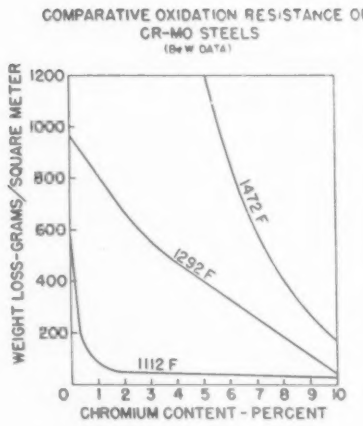


FIG. 10: Graph showing rates of oxidation of CrMo alloy steels as compared with plain carbon steel.

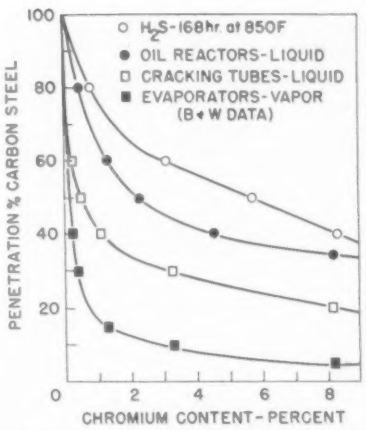


FIG. 11: Graph showing relative rates of corrosion of low alloy CrMo steels in various refinery services.

of a particular alloy depends upon a combination of temperature and hydrogen partial pressure.

For many refinery or other operations involving hydrogen at pressures below 200 psi at 1,000 F, plain carbon steel can be used. As the hydrogen pressure increases at this temperature, higher alloy steels are required. Upper dashed portions of the curves (Fig. 9) represent a change from hydrogen fissuring to decarburization without fissuring.

Thus, at 1,200 F, ordinary mild steel will decarburize in hydrogen at 100 psi hydrogen partial pressure without forming any fissures. But the decarburized steel will exhibit a significant reduction in tensile strength because of a loss of the strengthening iron-carbon alloy compound.

Resulting increase in oxidation resistance with an increase in chromium content is a third determining factor in selection of CrMo steels.

Figure 10 is an example of the significant increase in this resistance, particularly at elevated temperatures. It is interesting to note that at temperatures up to about 1,100 F, resistance of 1¼ CrMo steel is about equal to that of 9 or 10 CrMo steels.

Since this temperature is almost the extreme for most CrMo steel usage, low-alloy CrMo steels would be as effective as the intermediate types from a scaling point of view.

Refinery operations involve liquids and vapors of varying sulphur contents. Figure 11 shows some typical curves for resistance of various CrMo steels to these vapors or liquids as compared with plain carbon steel.

Again, the maximum change is produced with only a small amount of chromium additions, so in many cases, the lower alloyed CrMo steels would offer adequate protection against most refinery liquids. In some environments involving hydrogen sulfide-bearing vapors, low CrMo steel resistance to attack is about equal to 9 CrMo steels.

A final determining factor in steel selection is strength at elevated temperatures. Figure 12 is a plot of the maximum allowable stresses permitted under the ASME Boiler and Pressure Vessel Code for various CrMo steels.

The allowable stresses are based on certain criteria —such as creep at elevated temperatures—which have been determined by various laboratories. Consequently, the stresses may show pronounced variation from one laboratory to another.

It is interesting to note that mere addition of higher chromium amounts is not an indication of increased allowable stress. The 7 CrMo alloy has a lower allowable stress than all other CrMo steels. For temperatures up to about 950 F, plain carbon ½ Mo or low CrMo steels have equal or higher allowable stresses than higher alloy steels.

At about 1,050 F, 1¼ CrMo and 2¼ CrMo steels have higher allowable stresses than even 9 CrMo steel. And at about 1,150 F, 2¼ CrMo has the highest allowable stress of the entire CrMo alloy series.

This data indicates high-temperature strength does not increase directly with increased chromium content. From the standpoint of most refinery operations, it is probable that the lower alloy CrMo steels would be adequate, since most refinery piping, other than furnace tubes specifically, operate at temperatures below 1,000 or 1,050 F.

(In the next issue of the WELDING ENGINEER, *Mr. Bland will evaluate the effects of preheat and postheat treatment on weld properties in chromium-molybdenum steel pipes.)*

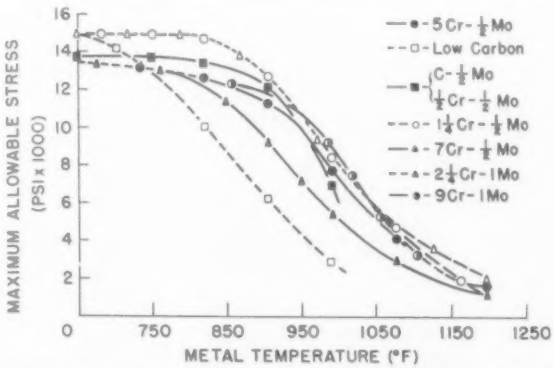
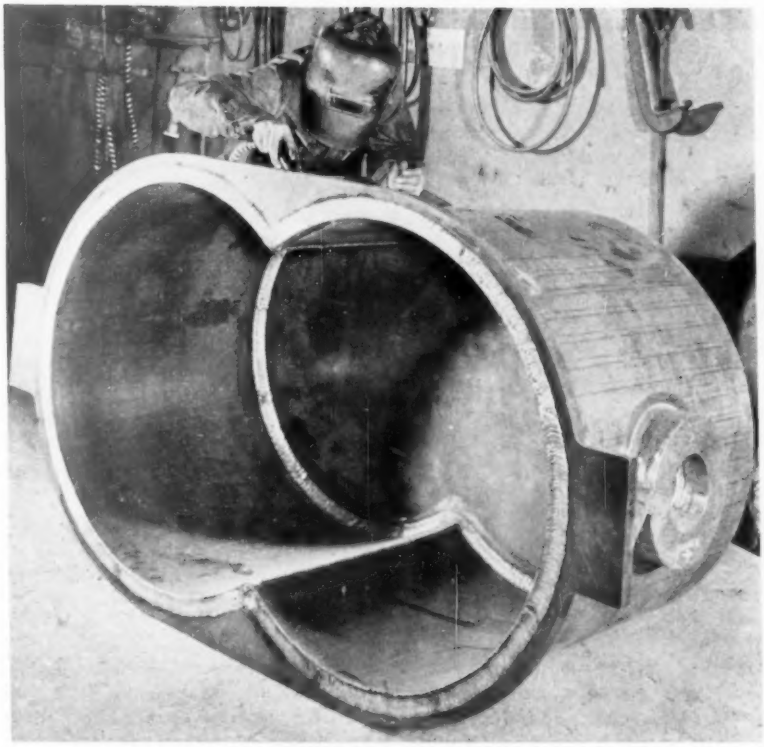


FIG. 12: Variation of maximum allowable stress with temperature for several CrMo alloys, based on section 8, ASME Unfired Pressure Vessel Code.



PART of dynamite bowl is tack welded prior to Mig welding outside seams.

Mig and Tig used to weld dynamite mixers

THEY JUST DON'T make mixing bowls like they used to—especially if you're mixing dynamite.

J. W. Starrett Products Co., Algonquin, Ill., recently changed the design for its figure-eight type dynamite mixing bowls from cast to fabricated structures with the help of Ampco Metals, Inc., Milwaukee.

Rolled aluminum-bronze plate was chosen for the job because of its ability to meet the manufacturer's exacting specifications.

Good Qualities

To determine "explositivity," gun powder was placed on a cube of selected material while a tilting slide directed a ball onto the powder. With greater slide angle, the ball traveled faster and increased chances of causing sparks and a detonation. The explosive quality of the metals to be used were judged in this manner.

Besides being the most spark-resistant metal, the aluminum-bronze plate has long life (eight times that of other materials tested), and is resistant to TNT's nitrate corrosion and the granular wear usually present in powder mixing.

The bowls operate with vertical, multiple-arm, copper-alloy paddles providing maximum efficiency and product uniformity. After mixing, dynamite has a tendency to sour and becomes highly explosive if trapped in crevices or holes, so extreme caution must be used in all phases of construction.

Welding Processes

The top flange and bowl bottom are 1¼ in. thick with 1-in.-thick sides. All plates, beveled to a 35-deg angle, are cut on an automatic continuous-metal saw.

Main outside seams were joined by the Mig (metal inert-gas) process while Tig (tungsten inert-gas) guns were used for all tack welds and all inside seams. Both processes used ECu A1-A bare spooled wire or filler rod.

When Mig welding, a 1/16-in.-diameter electrode was used with reverse polarity d-c current at approximately 325 to 335 amp. A mixture of 70% helium and 30% argon was used as a gas shield.

Tig welding was done with a ⅛-in.-diameter thoriated-tungsten electrode and ⅛-in. filler rods, using straight polarity d-c and helium gas shield. Tack welds were made at frequent intervals to assure proper alignment. The only precautions necessary were good welding practices. Postheating was not required.

Rigid specifications required that no inside blemishes or weld pinholes be present, so all surfaces and welds were ground smooth and X-rayed. On final inspection, all inside surfaces were dye-penetrant inspected.

In addition to having greater strength and better appearance, cost of the welded mixing bowl was less than cast bowls—and loss of castings due to porosity was eliminated.

WELDOR joins inside seams of mixing bowl with Tig gun and filler wire.

WELDING stainless steel to worn sleeve. Note shell is tack-welded before main welding is begun.

Nature foiled again!

Welding and stainless maintain water turbines

By Lloyd McWilliams

NATURE'S TREMENDOUS water power in Canada has been harnessed for many years to aid and promote new industries. But this same power presents new wear and corrosion problems in the maintenance of large water turbines.

Welding and stainless steel have solved these two problems.

Bearing liners on turbines built 30 to 40 years ago were rubber and were lubricated by water. Although the water is screened and filtered, abrasive matter still erodes sleeves and bearing liners.

After a few years of such wear, leakage can no longer be prevented. The purchase of new sleeves is a costly answer. The only economical solution for reclaiming worn guide-bearing sleeves is by welding stainless steel shells to them.

Metallized Surfaces

Rebuilding sleeves by metallizing was partly successful. But since there is no metal fusion and they wear at bearing locations usually absorbed by the shaft, built-up surfaces did not withstand the constant pounding and heat. The deposited metal layer peeled and both sleeves and bearing liner were ruined.

Stainless-clad sleeves were considered for a time, but their use was delayed because of the erroneous idea of possible warpage from welding stainless sheet to a thin-walled sleeve. Only through welding can these stainless shells be applied to the old sleeves.

Job Cost

Rolling, machining and grinding stainless plate takes time and money, but a stainless-clad job can be done for approximately $1,000, as compared to a cost of $4,000 for a new sleeve.

Taking care to insure uniform heat, stainless shells were first successfully welded to small turbine sleeves with an 11-in. shaft. Shaft diameters on the larger turbines run 23 to 24 in., with outside sleeve diameters of 26 to 27 in. For these larger jobs, 4 ft by 8 ft stainless plate was used in thicknesses of $\frac{1}{4}$ and $\frac{5}{16}$ in.

Mandrels for various shaft sizes having been previously made, sleeve surfaces are cleaned on a lathe. Finished sleeve diameter must be decided at the beginning to insure a good wall thickness for the stainless.

Since the sleeves are ribbed on the inside diameter, too much metal cannot be removed. Knowing the diameter of the machined sleeve, the stainless sheet is then rolled to comparable size and cut into halves. The sleeves are split, so they can be removed

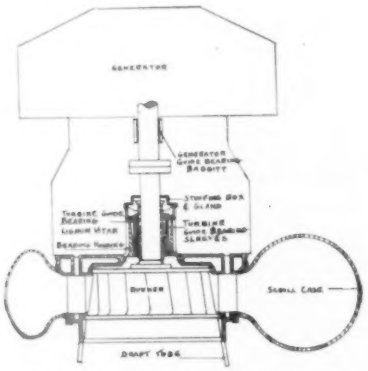
VIEW of a finished sleeve and a pre-formed stainless shell. Below, a badly grooved guide-bearing sleeve ready for face-lifting.

from the turbine shafts without dismantling the unit.

Tack Welding

The half-sections are then clamped firmly to the sleeves and tack welded around the circumference and at the split. Openings in the shell are cut out where high-tensile steel stud bolts holding the sleeves to the shaft are located.

After tack welding, edges around the stud bolt openings are also welded, insuring water-tightness. One or more ½-in. holes are drilled through the stainless shell face into the sleeves. These holes are then plug-welded to eliminate any tendency for the shell to bulge.



SECTION through hydro-electric unit showing guide-bearing and runner.

When welding the stainless shells to mild steel sleeves, 5/32-in. 301 type electrodes are used at 140 amp. No preheating or other preparation is necessary before welding.

As short an arc as possible should be held without choking or sticking. Only enough current to obtain a free-flowing arc and good fusion should be used. One pass only is required and excess metal can be ground off.

After Welding

With all welding completed, the stainless-clad sleeves are bolted together on their mandrel, placed in a lathe and machined, leaving about 0.010 in. for grinding.

Although the majority of sleeves rebuilt were steel, the stainless has also been welded to old bronze sleeves. Suitable electrodes had to be chosen for the job.

Experimental work was done with different classes of bronze, brass and copper electrodes before choosing an ECuSN-C type, which gives a dense, high-strength deposit and is easy to handle.

Using a 5/32-in. electrode (held at an angle) at 140 amp, the arc heat was directed back over the work, helping gases to bubble to the surface. As in welding the stainless shells to the steel sleeves, only one pass is required and weld metal is machinable.

Pitted Runners

Another long-standing problem in hydro-turbine maintenance has been pitting of runners or water wheels which results in a loss in output. But pitted runners can also be reclaimed by welding, using mild low-hydrogen steel to fill the cavities and applying a protective stainless steel layer.

Vulnerable areas can be fairly well determined from tests and many manufacturers are now applying stainless overlay to new runners before installation.

Vapor masses formed when pressure at a given point decreases will collapse and cause high pressure. After as short a period as 100 hours of this pressure, previously smooth steel plate is visibly roughened.

FINISH grinding on the stainless-clad sleeves is done by the wet method.

Major Repairs

Blades should be filled-in and covered with a stainless overlay as soon as cavitation and pitting is indicated. If allowed to continue, major repairs will be necessary.

On large runners weighing 40 tons, it is not unusual to lay a ton or more of mild steel weld metal. With a mass this size, stress-relieving and preheating must be considered, since there is danger of cracks in the under-weld due to rapid chilling.

Runner removal means a complete

An extra role for welding

WELDING ALSO PLAYS a role in rebuilding wicket gate stems on a hydro-electric turbine using stainless steel.

Wicket gates regulate water flow to a turbine runner. The stems and their bronze bushings become worn, grooved and corroded, necessitating renewal of bushings and rebuilding stems to their original diameter.

This is done by welding a stainless overlay on the worn areas, or by machining off faulty metal and shrinking a pre-machined stainless sleeve over the stem. The latter is also welded and later machined and polished.

The stainless sleeves were cast in lengths of 6 in., with a 5-in. ID and a 5½-in. OD. Sleeves were bored undersize 0.004 in. and heated to 200 F, then shrunk on the prepared stem. They are tack-welded to prevent any shifting.

Electrodes used were 5/32-in. type 308 at a current of 135 amp.

ASBESTOS tape on sides of work holds heat in the area and prevents quick chilling.

Stainless sleeves are installed at the short end, or bottom stem, where greatest wear is located.

On the top, or long stem, the repair was made by welding 303 stainless to the pitted areas. Vanes were placed on horses and rotated to decrease distortion with a circular pass. After welding, vanes were machined and polished.

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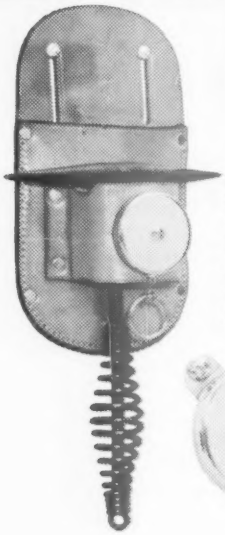

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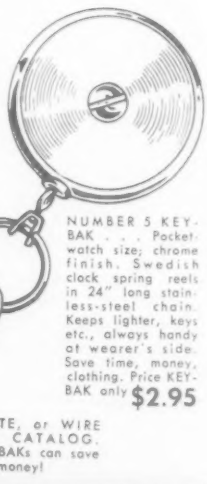

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dismantling of the unit, which may be in need of a general overhaul anyway. But some runner blades are pitted after only 2 or 3 years of service. In this case, units are stopped only long enough to lay the stainless and stop further pitting.

Before Welding

It is important that the overlay extend well beyond pitted areas. Pitting in the "etched" or shallow stage is easily repaired by cleaning surfaces and applying the protective layer. Repair is done without removing the runner. Most pitting develops on the under, or discharge side of runner blades.

All pitted, sponge-like metal is gouged with an arc-air torch or carbon electrodes. More than 500 amp is required for efficient gouging when

WELDOR fills cavitations on discharge side of runner blade.

using $\frac{1}{2}$-in. electrodes, so two 500-amp rectifier units are connected in parallel. Operating between 600 and 700 amp saves time and does not overload the welding units.

Because of stainless steel cost, low-hydrogen E7016 electrodes are deposited to within $\frac{1}{8}$ in. of the desired finish prior to applying the stainless overlay. Both $\frac{1}{4}$ and $\frac{5}{32}$-in. electrodes are used at 200 and 135 amp respectively.

Several mild steel electrodes, including E6010, have been used for filling-in, but low-hydrogen electrodes are favored because of less danger of underweld cracks and because of required low temperature preheating.

Welding Set-up

On large jobs, four welding units located outside the turbine scroll case generally are used. Two rectifier units of 500 amp and two rotating units rated at 400 amp are used. Asbestos cloth curtains protect each weldor from other arc flashes.

Banks of infra-red lamps mounted 10 in. from the work were sufficient for preheating. Although the job was done at scroll case temperature of 40 F, the lamps raised the temperature to approximately 140 F.

Some holes only required 50 lb of mild steel and 150 lb of stainless for the overlay. Since previous repairs required up to 2,500 lb of mild steel plus 1,500 lb of stainless overlay, the economies of making repairs in the "etched" stage can be seen.

Electrode Choice

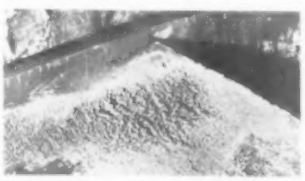
For the stainless overlay, both 301 and 308 stainless electrodes have been used. However, 308 is favored because it is machinable and has excellent resistance to impact and abrasion.

When working overhead, beads must be properly closed or cavitation will develop under the overlay. For the most part, $\frac{5}{32}$-in. electrodes with a current of 130 to 140 amp are used. Some $\frac{1}{8}$-in. electrodes are used to fill-in between passes of the $\frac{5}{32}$.

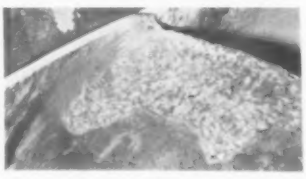
Grinding is required to smooth weld metal, but with a 100% finish there is danger of grinding through the thin stainless overlay. Generally, a 25% finish is satisfactory.

On examination, blades with heavy pitting had more abrupt curvature ahead of the pitted area. Correcting the curvature helped water flow and decreased cavitation.

On some runners pitting is at the fillet of the blade and band; on others, only at the trailing edge. Each repair demands a slightly different technique, but in all, welding has proved indispensable as a maintenance tool.



PITTING at the lower discharge side of blades caused by abrupt curvature. Below, view of pitted areas after smoothing prior to welding.



WELDOR joins bolsters and cross bearers to used sill, making up floor frame sub-assembly of gondola car.

Steel plant gondola cars fabricated by welding

By Robert Losee

Lincoln Electric Co.

RUMBLING OVER the intra-plant tracks of a midwestern steel company are 45 new gondola cars which, for ruggedness and sheer "beef," have few counterparts.

Made by Ortner Car Co. of Cincinnati, the cars are used to carry steel coils in loads up to 100 tons each.

To cite just a sampling of the fabricating components involved, the cars feature $\frac{3}{8}$-in. sides; ends and floor plates; heavy rolled H-beam end stiffeners and side stakes; thick angle sections for fishbelly reinforcing and floor supports; overlapping angles around the entire upper rim; and corner reinforcing angles inside and out.

Part Positioning

Fabrication was done entirely by manual metal-arc welding; either flat in fixtures with components clamped by hydraulic jacks and hold-down bars, or "in position" as the car was being assembled. In the latter case, a considerable amount of overhead, vertical and sloping welds were involved.

Although these cannot be run as fast as downhand or flat position welds, a comparatively new all-position, iron-powder electrode facilitated the work. Use of this E6013 electrode gave weldors a minimum of spatter, good quality deposits and easy cleaning because of readily peeling slag.

Welded Bolsters

Heavy-duty bolsters were comprised of two thick web plates welded to both the center sill and to wide top and bottom flanges. The lower flange —a single plate formed in a press brake—slopes upward on both sides of the center sill at about 25 deg over the wheel line, then down again at 45 deg to the outer ends. All welding was done in position with two passes of a $\frac{3}{16}$-in. electrode.

Used sills and trucks, still structurally suitable, were employed to keep costs as low as possible. A filler

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P&H welders • electrodes positioners

Cuts welding time 30%

on galvanized iron

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AMPCO-TRODE 10*

Aluminum-Bronze Electrodes

In welding this giant hood fabricated from 16-gauge galvanized sheet, engineers at Caterpillar Tractor Co., Peoria, Ill., found that Ampco-Trode 10 pays off six big ways:

1. It applies at a faster rate of travel — burns away less galvanizing at joints.
2. It produces sound, water-tight welds.
3. It resists corrosion.
4. A minimum of joint preparation is necessary.
5. Beads are smooth — penetrate uniformly.
6. Deposit mechanical properties compare to those of the base metal.

Ampco-Trode 10 performs profitably also in metal-arc welding of brasses, aluminum bronzes, silicon bronzes, some nickel alloys, dissimilar metals — and overlaying bearing, corrosion- and wear-resisting surfaces.

Order Ampco-Trode 10 from your nearby Ampco distributor. Or mail coupon below today.

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plate was welded the full sill length on top to give a flush surface with transverse flanges of bolsters and cross bearers.

Car Flooring

Four $\frac{3}{8}$-in. plates make up the floor, with a welded seam running down the sill center and across at mid-point. A $\frac{1}{2}$ to $\frac{3}{4}$-in. gap was left between floor plates and filled with two passes of $\frac{3}{16}$-in.-diameter E6027 electrodes at speeds of 17 ipm.

Specifically designed for welding in downhand or flat position, the electrode has a substantial percentage of iron powder in its heavy coating to permit high current settings, self-cleaning slag and weld quality equivalent to automatic submerged-arc techniques.

H-beam stiffeners on the car ends also were attached with iron-powder electrodes, employing 6-in. intermittent welds for minimum spatter and maximum speed. Since excessive spatter gives a poor appearance after painting, the minimizing feature was put to good use on stiffener welds.

Backstep Welding

Side plate assemblies, with floor and fishbelly support angles, were positioned in work-height fixtures for maximum welding speed. To avoid bowing the 40-ft side plates, backstep welding was employed in 20 to 22-in. increments in both directions from the car center line and on both top and bottom sides of the angles.

This sequence balanced heat stresses and equalized heat distribution, so no plate distortion was encountered when the four continuous corrosion-sealing welds were completed. Drainage holes were provided at each corner.

To handle the various welding set-ups—some requiring a-c current and others d-c—a multi-purpose, combination a-c/d-c welder was used.

Depth of the car's fishbelly side below floor level was 28 in., almost equal to the 32-in. height of sides and ends above the floor line. Such depth adds considerably to strength and stiffness of sides, minimizing possible excessive longitudinal deflection under load.

The car floor, side and ends are free of any interior obstruction which might lead to damage of the coiled steel in transit. For further support, four lengths of steel angles were turned over and welded to the floor plates to hold the coils firmly.

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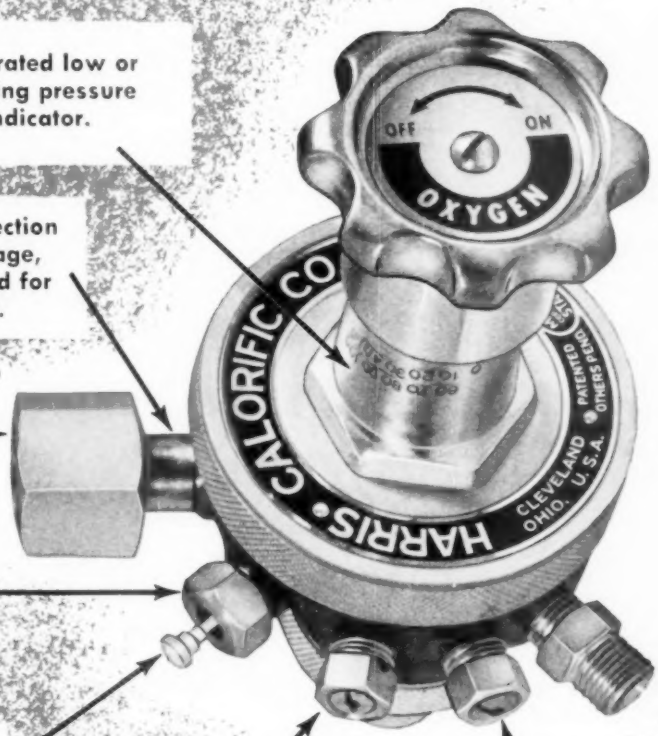

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Electrodes

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Electrodes match chemical and heat-treating analyses of many alloy steels. You get higher heats for faster deposition — better impact over a wide temperature range — and easier handling. "As welded" tensile strength up to 275,000 lbs. psi. Get Bulletin R-29. Write Dept. 314B, Harnischfeger Corp., Milwaukee 46, Wis.

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P&H
welders
electrodes
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LACING is welded to extruded aluminum chords to form beam for "Alrectic," newly-developed prefabricated substation system. Substation can be erected in less than a day with strong, light aluminum components, says manufacturer.

Mig weld aluminum for prefab substations

In less than a day, a new welded, prefabricated aluminum substation can be erected. "Alrectic," the method used to erect the substation, was developed by Handley-Brown Co., Jackson, Mich., with design and engineering help from Kaiser Aluminum & Chemical Sales, Inc., Chicago. Utilizing standard prefabricated aluminum components, "Alrectic" was recently put into action as a 46 kv substation for Consumers Power Co., Alma, Mich.

It took just six hours to raise and position the sections after they were ground-assembled.

The Mig-welded trusses consist of four extruded aluminum chords supported by lacing. Sides and ends are precision punched with holes spaced at 3 in. intervals. To assemble, trusses are bolted together to form columns and horizontal members.

Trusses are 1 ft sq or 1 by 2½ ft. Aluminum extrusions permit single trusses up to 60 ft long, about three times the maximum length of conventional galvanized steel members.

Taking advantage of aluminum's high strength-low weight ratio, most members can be raised into position by one or two men. A 10-ft truss of the 1-ft-sq size weighs 94 lb, compared to 290 lb for an equivalent steel component. A 16-ft aluminum section weighs 145 lb; a comparable steel section weighs 443 lb. In load tests, a 10-ft aluminum beam successfully withstood 7,700 lb.

Maintenance costs are cut with the corrosion-resistant aluminum substation which requires no painting, says Kaiser Aluminum. The stations are flexible, and can be dismantled and reassembled in different form with no loss of parts.

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ON WELDING GAS COSTS

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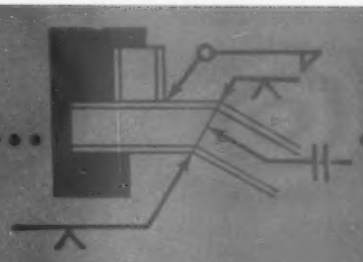


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Flame cutting stainless grades

Question:

We frequently are asked to flame cut chromium-nickel steel. But unless we take extreme care, the metal's corrosion resistance drops way down. Is there an easier way to do the job and still get high corrosion resistance?

Answer:

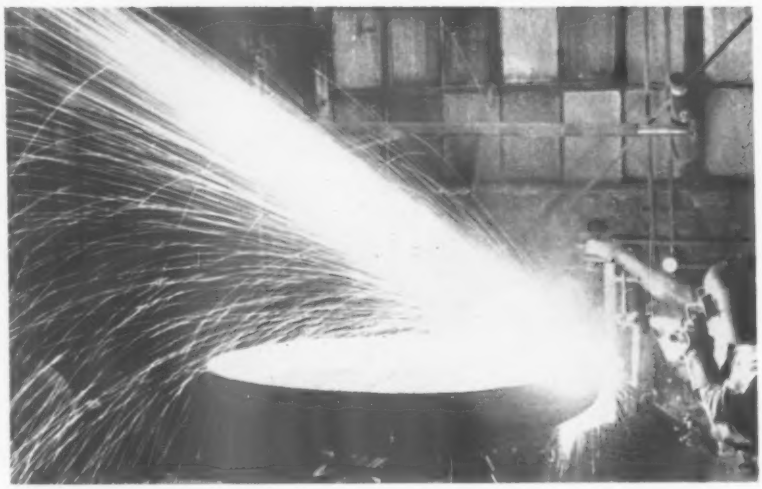
Corrosion resistance in chromium-nickel steels (except stabilized grades) is lowered by the high temperatures tied in with flame cutting and the general practice of slowly cooling to room temperatures.

There are two ways to offset this. The first is to fully anneal the entire piece—and follow with a quick cooling to redissolve precipitated carbides.

The second method is to machine away affected areas. The amount of machining you will have to do depends on the width and location of the heat-affected zone. Such zones may adjoin cut edges or be slightly removed. Zone width, too, may vary; according to cutting speed, heat input and the metal's composition and thickness.

To locate these zones, boil a sample in a 15% nitric—3% hydrofluoric acid (by volume) solution of water. The results will help you decide how much machining will be necessary.

The fact is, all commonly cut types of chromium lose corrosion resistance when they are heated over approximately 1,700 F. This includes types 405, 410, 430, 442 and 446. Heat treatment must therefore follow cutting if corrosion resistance is desired.



Allegheny Ludlum Steel Corp. has detailed the reason these grades lose their resistance to corrosion. Type 410, they point out, is air-hardened and must be heat treated after cutting to restore its ductility. A modified grade of 410—405—does not harden in air but it does become brittle in the heat affected zone because of the rapid grain growth and formation of brittle constituents at grain boundaries. Again, heat treatment will correct the fault.

Types 430, 442 and 446 also show marked grain growth if heated to 1,600 F for extended periods of time. In fact, areas close to the cut will be hotter than 1,600 F, and grain growth can be controlled only by limiting the time the metal is heated.

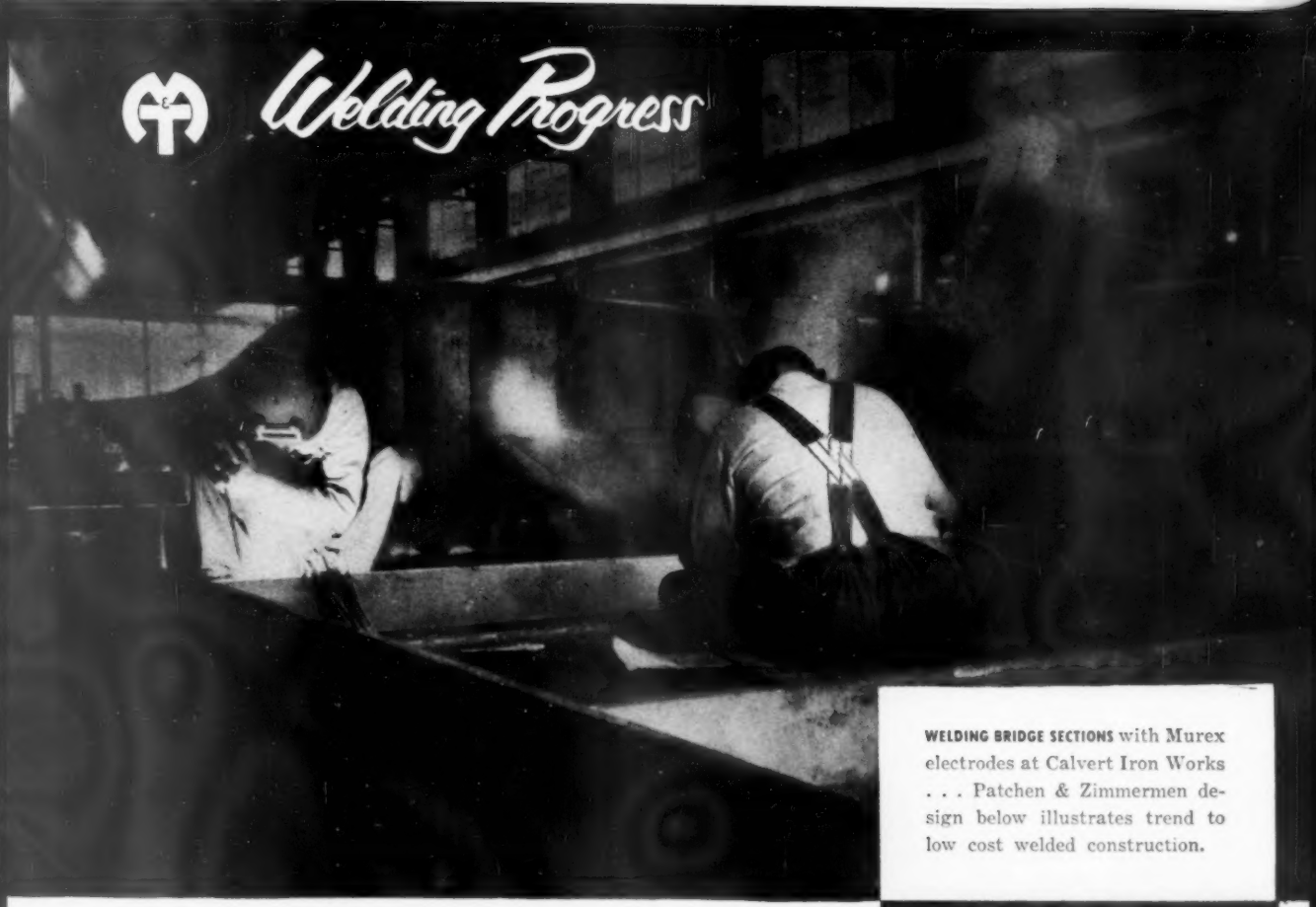
Types 430 and 442 also require heat treatment to restore corrosion resistance.

Before you flame cut, anneal all these grades. Preheating ahead of the cut at 500 to 700 F helps prevent cracking by reducing excessive thermal shock and sharp heat gradients.

Straight chromium types, unlike chromium-nickel grades, rapidly lose strength as heat increases. For this reason, fracture is likely to occur as stresses build while the metal expands and contracts.

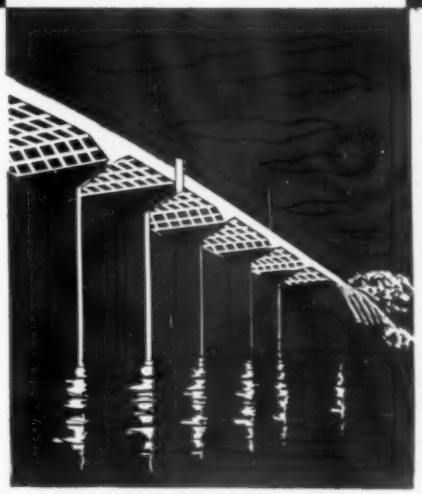
You might also try oxy-arc cutting. In the method, oxygen is fed through a flux-coated, tubular electrode made of mild steel.

Maintain an arc as you would when welding. Concentrate its heat at the starting point to begin fusion. The arc works as a heat source as the cut is made. As it melts, the electrode's steel oxidizes. The metal and flux enter the cut where they act like a slag by removing the refractory oxides as they form. Cuts are made by dragging the electrode's flux-protected tip along the line of the cut.



WELDING BRIDGE SECTIONS with Murex electrodes at Calvert Iron Works . . . Patchen & Zimmermen design below illustrates trend to low cost welded construction.

Welding Bridges with *MUREX*® Electrodes Cuts Costs



Time-saving techniques and substantial savings in welding costs have helped Calvert Iron Works to become one of the leading bridge builders in the Southeastern Area. Here's what they say about their use of welding in bridge construction:

"Welding offers substantial savings as compared with riveted construction."

On selecting electrodes for bridge welding, they say, "Metal & Thermit's Murex electrodes not only work faster, but also give us an ideal weld. X-ray rejects have been practically eliminated. We consider Murex electrodes to be the best available for the type of bridge welding we do."

Calvert, which does in excess of ½ million feet of bridge and structural steel welding each year, practices good buying economy too — 90% of their electrodes carry the Murex label, since the Metal & Thermit line of electrodes meets their arc welding requirements, and simplifies compliance with engineers' welding specifications.

Whether you join thin sheet or heavy sections . . . there is a large selection from M&T's line of Murex mild steel, low hydrogen, iron powder, hard surfacing, and stainless electrodes that can simplify your welding operation. *Write for your copy of the M&T Selector — an easy reference for finding the correct electrode for any application.*

METAL & THERMIT CORPORATION

GENERAL OFFICES: RAHWAY, NEW JERSEY

Arc vs gas welding on gray cast iron —which should it be?

GAS welding gray cast iron, says the author, is more expensive, more time consuming than arc welding.

By José Carlos Pellegrino

THE MOST commonly used cast iron is gray iron.

It is especially common in the auto industry—but there are, however, some drawbacks in this metal. At General Motors, for example, castings often come from the foundry pocked with blow holes, sand holes, pits, scabs, and other defects.

GM welding engineers know, of course, that such units can be salvaged by oxyacetylene welding, but they had an idea the same work could be done more efficiently and less expensively by metal-arc welding. They decided to do some experimentation to learn whether they were correct.

Their normal preparation for gas welding means the casting must be preheated in a furnace at temperatures below 1,333 F from one to three hours. Really heavy work, moreover, is frequently in the furnace up to ten hours. To this time must be added the occasional use of postheat.

All this is obviously a huge expenditure of time, labor and money.

For example, consider the equipment necessary for pre- and postheat; large furnaces, booms, hoists, etc. Work time varies from two to eleven hours, depending upon casting size, type of defect and repair quality. Cost: to the initial expense of equipment and its maintenance must be added wages and the hours workers spend operating the equipment.

Costs could be cut, engineers reasoned, if they could accelerate salvage operations. And a major economy would be effected by switching from an average gas welding speed of 2.8 ipm to 10 ipm with arc welding.

This theory was tested on a V-8 head, which was sawed into six sections. Holes were drilled in areas which could be machined as well as in locations which could not.

These cavities were similar on each sample in order to create almost identical welding conditions and aid engineers in comparing the effects of arc and gas processes. Three specimens were gas welded; three were arc welded.

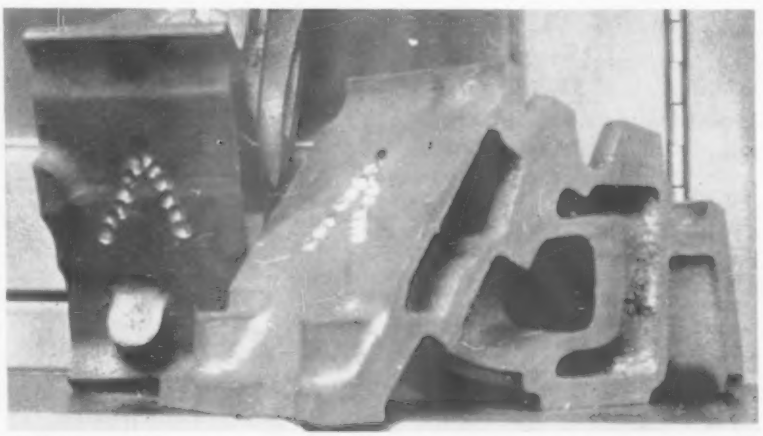
The first sample was gas welded. It was preheated by torch, then welded with a general-purpose cast iron rod and a great deal of flux. No postheat was used. Although 20 minutes were spent on welding, the machined specimen exhibited a considerable amount of porosity. This might have been due to either poor welding or a lack of adequate preheat.

A companion specimen—arc welded—consumed a total of four minutes, only one of which was spent in welding. Power was supplied by an a-c d-c rectifier unit set for reverse polarity d-c at 85 amp. A $\frac{1}{8}$-in. high-nickel electrode was used. Stresses were relieved at the weld joint by peening after each 1 in. or $1\frac{1}{2}$ in. of metal deposited.

The second and third gas welded specimens were preheated to 1,250 F for two hours in the furnace. With this preheat, joining time was cut to five minutes using the same rod and flux. Following welding, the units were postheated for four hours and allowed to cool slowly.

Even though weld appearance was not good, particularly for non-machinable surfaces, welds were otherwise perfect. No cracks, slag inclusion or porosity were found. Brinnell hardness readings were from 228 to 184.

The time saved by arc welding seemed to be its greatest advantage. The second sample took seven minutes to weld because of a large cavity. The third specimen took five minutes. However, it must be remembered that a great deal of time was saved by not using pre- or postheat. Brinnel tests on the weld, on the heat-effected zone, and at points between the two gave results of 228 to 184.



HEAD from a V-8 engine was used as a source of test specimens. Six sections were made for comparing arc and gas welding of the gray cast iron.

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Argon of 99.995% minimum purity

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The inert argon welding gas you get from LINDE is now *guaranteed** to contain *less than 50 parts per million* of impurities. And it's LINDE's regular industrial argon—not a special, extra-cost grade. You get this extremely high purity *on delivery* to you, regardless of the way the argon is delivered.

LINDE's 50 years of experience in producing gases of extremely high purity make this assurance possible. You can depend on LINDE *consistently* for the highest possible purity in the gases you use. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

*LINDE argon delivered as a liquid is the purest inert gas on earth. Guaranteed to contain less than 50 parts per million of impurities, LINDE liquid argon contains, on the average, less than ½ of this amount and practically no moisture.

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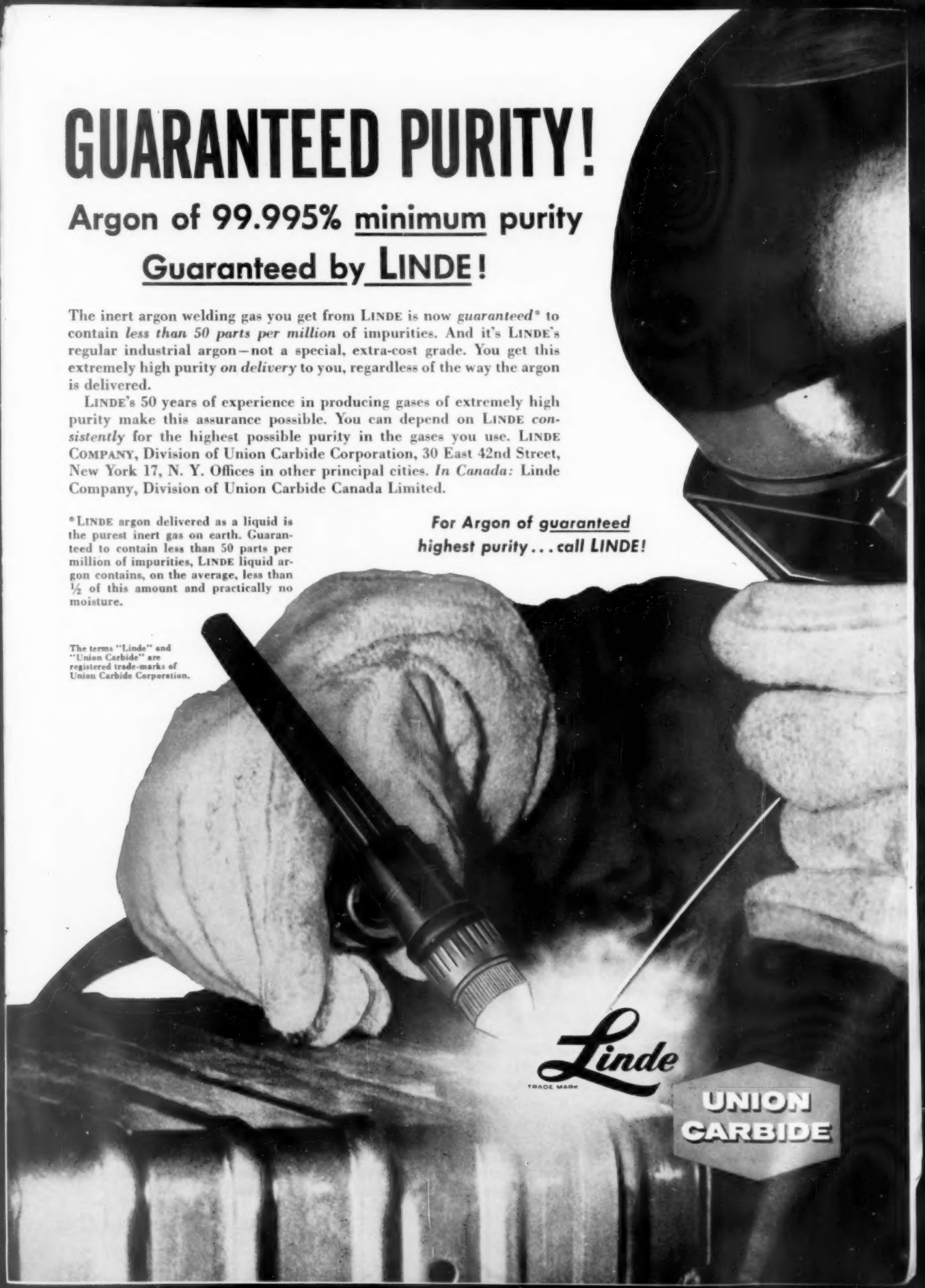
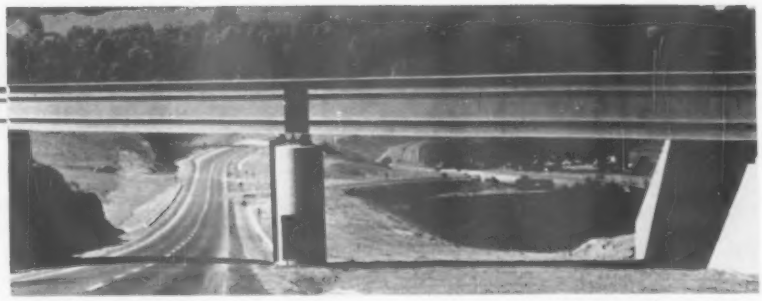


American Institute of Steel Construction reports . . .



WELDED railroad bridge of Delaware & Hudson Railroad at Cherry Valley, N. Y.

Less cost and better appearance through welded bridges

THE NUMBER OF WELDED bridges gracing the American scene is steadily increasing as designers and engineers turn to this type of construction to cut costs and improve architectural appearances.

In designing a welded bridge, engineers have considerably more latitude in selection of structural shapes and in make-up of members, while sections of almost unlimited size or shape—efficiently proportioned according to stress requirements—can be economically produced.

Add to these advantages the fact that welding processes and techniques have been perfected to eliminate much of the human error and to assure reliable welds.

It is easily seen why this type of bridge construction has made such great strides.

New York State's Department of Public Works is one pioneer in welded bridge construction. Since 1942, the department has designed and constructed approximately 800 steel bridges—almost all of which are of welded design.

Bridges on the New York State Thruway are mainly deck types incorporating composite construction. Welded fabrication permitted efficient, economical use of material since reduction in effective area because of connection holes was not necessary.

An estimated cost savings of 15 to 20% was realized through use of these welded designs over similar riveted structures.

One example is the 900-ft-long bridge spanning the Erie Railroad tracks at Suffern, N. Y.

The structure contains six main spans in lengths of 92, 99, 124 and 234 ft, as well as three 124-ft spans. In effect, there are two separate bridges alongside each other, each having one 49-ft-wide roadway and two catwalks 3 ft 8 in. in width.

Seven lines of girders (heaviest single girder is 175 ft long; weighs 55 tons) support each of the two expressway lanes, requiring a total of 84 girders for the six spans.

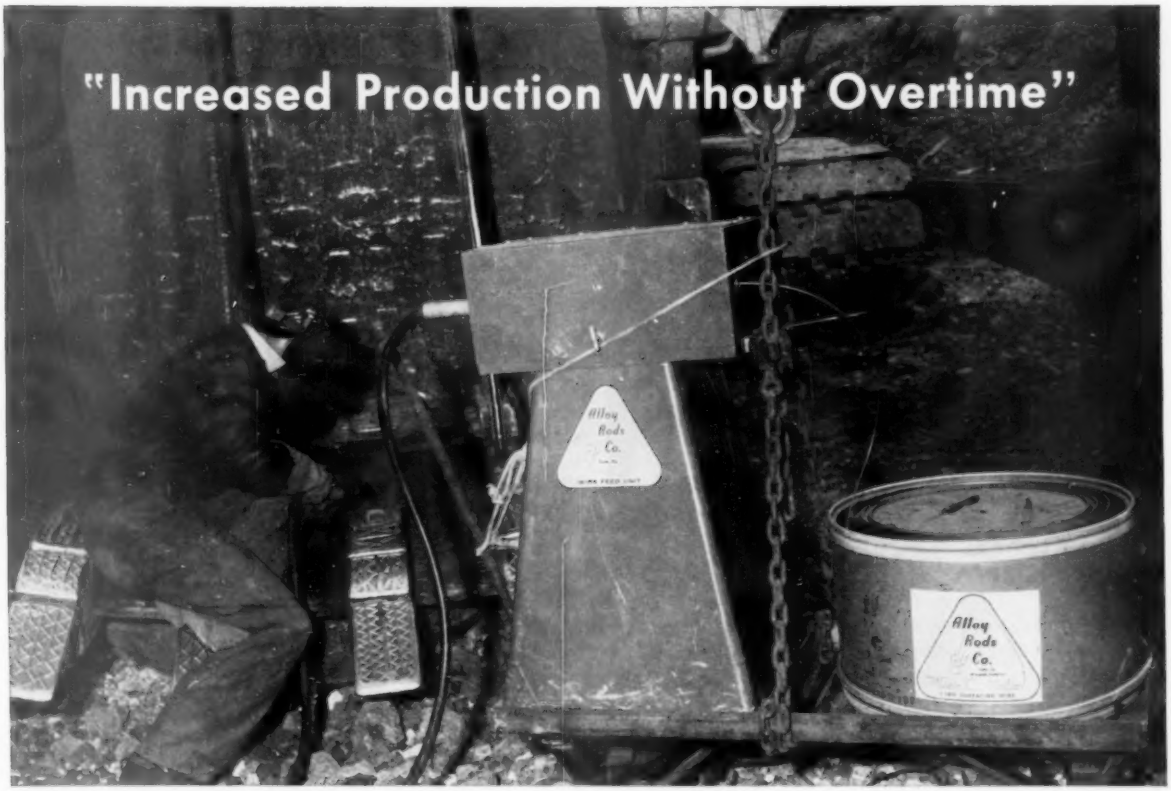
Cantilever girders supporting the suspended span have a depth of 11 ft over the piers and taper to 4 ft 8 in. at the ends.

Girder webs, varying from 3/16 to 3/8 in., were shipped from the mills in maximum lengths of 84 ft, and were butt welded to obtain the required full-girder length. Web stiffeners were tack welded into place, then fully welded before flange plates were attached.

On the face of the outside or fascia girders, vertical stiffeners were eliminated in favor of the more pleasing curved, longitudinal stiffeners, which followed the lower flange curve.

Flange plates had a uniform width of 24 in. and varied in thickness according to location—up to

THRUWAY bridge built by New York State over Cattaraugus Creek near Buffalo shows welded detail.



Hard Surfacing Semi-Automatically with WEAR-O-MATIC Yields Big Production Dividends for Custom Shop

The 5½ yard bucket shown above is being built up with Wear-O-Matic Nickel Manganese. This is a vertical weld on one of the grizzlies in the bucket. Over this will be deposited one pass of Wear-O-Matic 15. Perry Westlake has cut in half the time required on a job like this by using the Wear-O-Matic process.

Perry Westlake, Owner, Westlake Service, Burgettstown, Pennsylvania, does his best work while other men sleep. His custom hard surfacing of equipment must be done between shut down time at night and start up time next morning. This rigorous schedule has been the downfall of many contract weldors. Westlake solved this problem with the new Wear-O-Matic Semi-Automatic Hard Surfacing Process. "It would take an additional gasoline driven DC welding machine and another trained hard surfacing weldor to turn out the production we now get using the Wear-O-Matic process," says Perry.

Easier, continuous welding at faster speeds; quicker set up time per job; simpler wire change over and longer wearing alloy deposits have increased the efficiency of Westlake's entire operation.

A complete range of build-up and hard surfacing alloys packed in convenient 100 pound Payoffpaks provides longer wearing deposits for all hard surfacing requirements. The low initial cost of the Wear-O-Matic process makes the change over to semi-automatic hard surfacing feasible for every maintenance shop.

Your weldors will like the ease and convenience of the Wear-O-Matic process and you'll like the increased production. Write for Bulletin HS-102, Alloy Rods Company, P. O. Box 1828, York, Penna.

Alloy Rods Company

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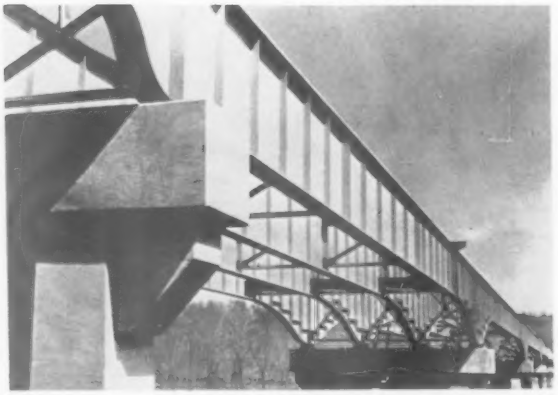
Alloy Rods Co.

3¼ in. at some points. Double-V butt welds joined the plates to required girder length, since they were also received from the mills in maximum 84-ft lengths.

Although the Thruway at this point is on both a vertical grade and a horizontal curve, the welded design provided the required flexibility to shape the bridge to site conditions, and represented a weight savings of 15% compared with riveted girders of constant section.



STEEL framework of Arkansas Turnpike bridge across Spring River at Hardy, Ark., is a welded structure.

NEW 236-mile Kansas Turnpike includes many welded bridges, including this all-welded one near Florence, Kan.

Among the all-welded bridges on the Thruway, one of the largest spans the Cattaraugus Creek near Buffalo, N. Y.

This 112-ft wide giant includes a deck with two 49-ft roadways, an 8-ft raised mall and two cantilevered sidewalks, and is supported by 12 lines of parallel girders on five 132-ft spans.

Girders were fabricated from web plates 66-in. deep and 7/16-in. thick, and flange plates varying in thickness from 1 to 3½ in. on the bottom and from 1 to 2½ in. on the top. Web stiffeners were plates 11 in. wide and 11/16 in. thick—except at the ends where 1-in.-thick plates were fitted flush.

The girders were transported without difficulty over 30 miles of curved highway between the fabricating plant and the bridge site on two trailing swivel dollies and a truck-tractor.

Top and bottom flanges were spliced by butt welding at four points in the top flange and six points in the lower flange of each 132-ft girder. Flange and web plates were connected by continuous fillet welds using automatic submerged-arc welders. The welds, on both sides, varied from 5/16 to ⅜ in., depending on steel thickness.

Stiffeners were fillet-welded to the underside of the top flange and to the web. However, at the lower ends, a filler plate (4 by ½ by 10 in.) was used between flange and stiffener to avoid having welds perpendicular to the stress line in the tension flange. The filler plate was first fillet-welded to the flange, then the stiffener was welded to the filler plate on each side.

Outside brackets of the fascia girders serve as stiffeners and supports for the cantilever concrete sidewalks. Brackets and fascia are covered the full bridge-length by a ⅜-in. plate for decoration. The plate is welded to the bracket ends for support.

The 8-in. concrete deck and steel girders were made into composite units by welding 6-in. spirals of ⅝-in. steel rod to the top flanges.

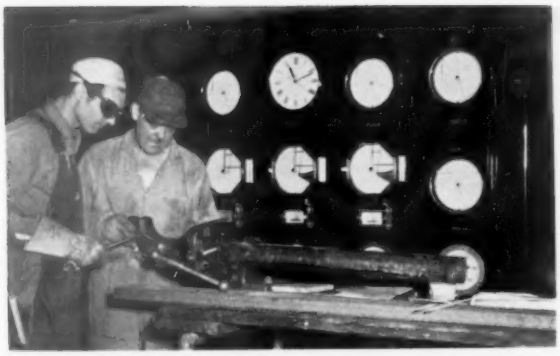
A welded railroad bridge has also been completed by the New York State Department of Public Works for a branch line of the Delaware & Hudson Railroad near Cherry Valley, N. Y.

The bridge is a through-girder, single-track, grade-separation structure of two 80-ft spans. Main girders, spaced 16 ft 9 in. center-to-center, were fabricated from 84 by ⅝-in. web plates and 20-in-wide flange plates varying in thickness from 1½ to 2½ in.

Longitudinal stiffeners of 6 by ½-in. plates were used on the exterior of the girders and intermediate vertical stiffeners were 9 by ¾-in. plates. Double groove welds were used for web and flange joining.

The weight of this all-welded bridge was 265,000 lb, whereas an all-riveted design would have weighed 305,000. This weight saving of 15% also represented a cost saving of 15% since unit price quoted was the same for riveted and welded design.

USING welded design for this Thruway bridge over Erie Railroad tracks at Suffern, N. Y., a 15% cost savings was realized.



CLAMPING device firmly holds pipe to be welded. Bank of instruments are air-conditioning gages.

Thanks to welding, it's cooler inside

By Fritz Foerste

HOW MUCH is customer comfort worth to a department store?

For Carson Pirie Scott & Co., one of Chicago's leading retailers, part of the price can be reckoned at a cool $5,000,000!

Cool, that is, because the firm has spent that amount to convert an open ventilation system to closed air-conditioning. In the latter system, water is cooled and pumped through closed pipes winding through the store. Not only does the water lower the building temperature but it also keeps the air clean—a real advantage in a soot-laden city like Chicago.

The job statistics are staggering in themselves: 1,117 000 sq ft of floor space, 15 stories, and one city block of departments, offices, and storage space had to be fully air-conditioned.

Altogether, York Corrugating Co. has worked 3½ years to install the system and is now putting finishing touches on the job.

Welding, of course, has been an invaluable tool in binding together the vast empire of pipes and tanks. No one knows exactly how many feet of welding has been laid in the past years. They do know that it must be an astronomical figure.

Consider the size of chill tanks alone: of the four used to store "ready-water," two hold 600 tons each; two hold 900 tons each. Before water is pressured through the schedule-40, 10-in.-ID pipes, it is cooled to—and held at 38 to 42 F. It must then flow throughout the building, making muggy Chicago summers bearable for shoppers.

But before weldors could splice in the new system, they had to flame-cut and remove the old one. Once they had eliminated unwanted portions, work went on apace. When WELDING ENGINEER's reporter visited the store, only four workers were still on the job—all weldors. They were tying in the last of the pipes in the sub-basement and through tortuous passages in the rest of the building.

Welding at this stage was done primarily by the oxyacetylene process; earlier, when larger pipes had to be joined, manual metal-arc welding was extensively employed. For this work, an a-c/d-c, 440-amp, three-phase welder was used. Electrode sizes were ⅛-in. and 5/32-in. E6010's, used on a reverse polarity setting.

For smaller pipes, however, welding was done faster and more easily with oxyacetylene. Pipes being laid during the last stages of the job were beveled 3/16 in. The root pass was made with a ⅛-in. mild steel rod, which was also used on the second pass. On the final pass, weldors used a 5/32 in. rod. Pipes were tested by forcing air and water through them under 30 psi pressures.

The company must expect its $5,000,000 investment to return dividends, for it has already installed similar air-conditioning units in its five suburban outlets.

COMPLETING a weld on one of the many air-conditioning pipes that will help cool one of Chicago's largest department stores.

JOINING a pipe that must be fitted in a twisting passageway. Helper is trade school student gaining practical experience.

Lessons Learned on America's First All-Welded Aluminum Yacht Can Help You!

The hull of *Dyna*, America's first all-welded aluminum yacht, will be exposed throughout its life to great stresses, a corrosive environment, and constant battering and vibration. To meet this challenge, Burger Boat Company, of Manitowac, Wisconsin, turned to Alcoa Alloy 5154 and the inert-gas consumable electrode welding process.

Welders at Burger Boat Company had formerly worked exclusively with steel prior to building *Dyna*, yet they had little difficulty in adapting their skills to aluminum. They found that aluminum could be welded at a faster rate than steel, and with relative freedom from warping and distortion. Further, the light weight of the aluminum sections eased handling problems and speeded assembly.

This is another example of the many exciting possibilities in welding, brazing and soldering Alcoa® Aluminum and its alloys. Get in touch with your nearest Alcoa sales office for the kind of design and welding assistance that Alcoa was able to offer Burger Boat Company. For welding materials, contact your local Alcoa distributor listed at the right. For booklets and films that show how easy it is to weld, braze and solder aluminum, write Aluminum Company of America, 1740-G Alcoa Building, Pittsburgh 19, Pennsylvania.

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Exciting Adventure
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Your Guide to the Best in Aluminum Value

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

ALABAMA
Birmingham
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COLORADO
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ILLINOIS
Chicago
Machinery & Welder Corp.
Steel Sales Corp.
Moline
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Southern Oxygen Co.
Whitehead Metal Products Co., Inc.
Syracuse
Brace-Mueller-Huntley, Inc.
Whitehead Metal Products Co., Inc.

NORTH CAROLINA
Asheville
Southern Oxygen Co.
Charlotte
Southern Oxygen Co.
Greensboro
Southern Oxygen Co.
Raleigh
Southern Oxygen Co.

OHIO
Cincinnati
Williams and Co., Inc.
Cleveland
Nottingham Steel & Aluminum Co.
Williams and Co., Inc.
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OKLAHOMA
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TENNESSEE
Kingsport
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Roanoke
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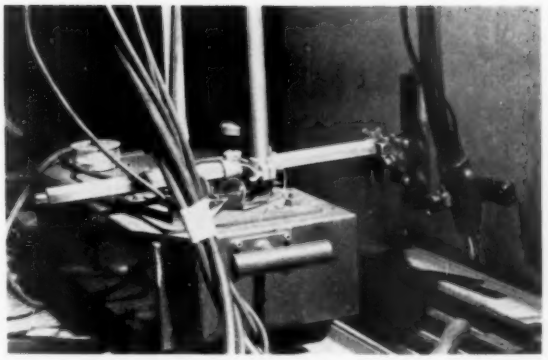
Seattle
Pacific Metal Co.
J. E. Haseltine & Co.
Spokane
J. E. Haseltine & Co.

WEST VIRGINIA
Bluefield
Southern Oxygen Co.

WISCONSIN
Milwaukee
Machinery & Welder Corp.
Steel Sales Corp.



MANUAL Mig welder mounted on tractor.

Fins for sure!

SHIPPING RADIOACTIVE MATERIALS is a ticklish job. Should some flaw develop in shipping containers, there is the not-too-remote possibility of the escape of deadly rays.

To insure against this occurrence in the transportation casks they fabricate, O. K. Kelley & Co., Boston, uses over 13,000 ft of Mig (metal inert-gas) welding.

In fact, the major part of the company's facilities is devoted to nuclear reactor and component equipment, much of which demands welding. The firm's specialty, however, are lead radiation-protective installations.

One place this protective equipment is vital is in atomic-powered submarines. The U.S.S. *Nautilus*, for example, has built-in shielding walls to guard its crew against radiation from the powerful engines. The U.S.S. *Sea Wolf* is similarly equipped. And so are AEC "hot" laboratories and X-ray rooms.

It was as no neophyte, then, that Kelley & Co. approached the task of fabricating eight transportation casks for radioactive materials.

Core of the casks is 8¾-in-thick lead. To this is bonded carbon steel clad with stainless. Hundreds of fins are attached to this unit as a means for heat transfer.

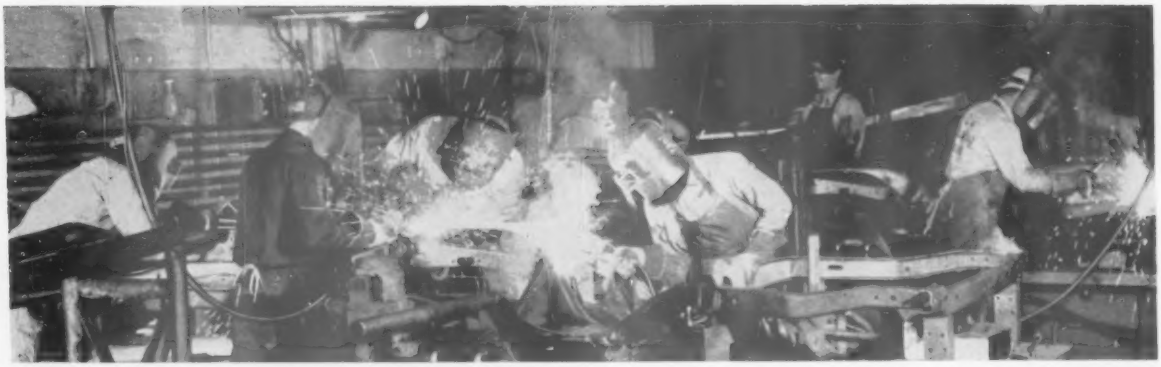
Joining ½-in.-thick fins to the casks presented the problem. Each of the four sides have 98 fins, which must be fully penetrated by welds.

INSPECTING heat-transfer fins on cask after welding is completed.

Scaffolding was therefore erected to permit use of a platform-elevator to carry an automatic Mig welder. This enabled the Airco machine to work on fins at various levels; making many 4-ft-long welds.

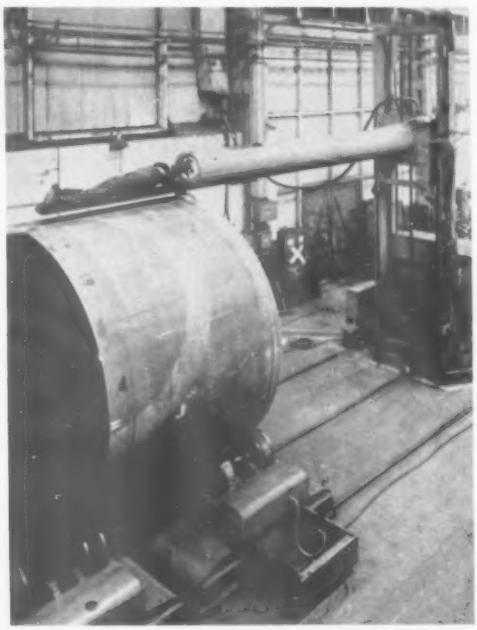
Full-penetration welding meant fins had to have 45-deg bevels. Once so prepared, they were welded to casks with three passes of the tractor-mounted welder. Shielded by a mixture of argon and helium, 308 stainless filler wire was used for the welds.

WELDOR clambers on elevator with Mig setup to weld fins to cask.



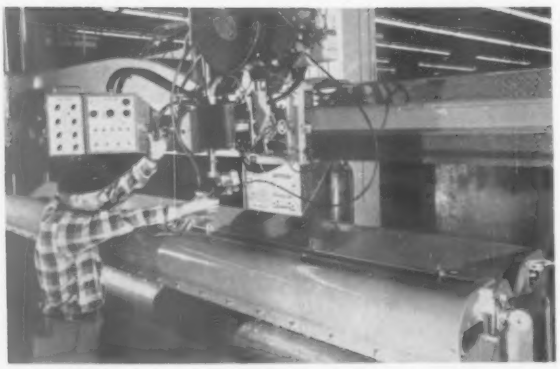
NEW air-cooled, semiautomatic Mig gun by Hobart Brothers Co. welds a 5-in. vertical seam where sidebars overlap on an automotive frame. On the mild-steel frames, the manufacturer, Parish Pressed Steel Div. of Dana Corp., uses CO_2 as a shielding gas. Wire is fed from 500-lb coils. The air-cooled "Migarc" gun is light and easily manipulated, reports its user, and he is able to reach welding speeds greater than 200 ipm on ideally positioned fillet welds.

VICKERS-Armstrong (Engineers) Ltd., England, installed a Quasi-Arc Ltd. welding head on this boom, which will accomodate various tank sizes. A traversing roller bed supports, turns and moves weights up to 48 tons, and adjusts to fit vessels from 2 to 15 ft in diameter.



On the Job . . .

METAL-ARC welding joins an elbow section during installation of 8,409 ft of black and galvanized steel pipe in a Virginia hospital. Pipe was manufactured by Spang-Chalfant Div. of National Supply Co.



THIS Tig welder, which was built especially for Boeing Airplane Co., joins alloys of hard-to-weld metals. An automatic machine, it is also capable of a high degree of sequential programming.

4 in 1

3 in 1

2 in 1

WELDERS/ POWER PLANTS

Hercules (Lycoming design) air cooled engine

FIREBALL AMPERAGE RANGES

Tungsten Inert Gas		Metallic Arc	
DC	AC	DC	AC
35-100	35- 75	35- 80	35-100
85-225	65-160	75-175	65-160
170-375	150-375	125-350	110-400

DAH-350 FIREBALL four-in-one model is the only complete unit made to incorporate an ac-dc welder for (1) metallic arc, or (2) tungsten inert gas welding, plus (3) ac power plant, and (4) 1 KW dc power while welding. Twelve separate amperage ranges as shown above. Additional standard equipment features include a polarity switch, either continuous or "start only" high frequency and an automatic inert gas control panel with solenoid valve and postflow timer. Rated output at 100% duty cycle: 250 amps dc tungsten arc; 300 amps ac tungsten arc. Generator: 10 KW of 115/230v, single phase, 60 cycle ac.

DA-300 BIG RIG. Combination ac-dc welder, plus an ac power plant, plus 1 KW of dc power while welding, give this model three-in-one versatility. Generator rated at 10 KW of 115/230v, single phase, 60 cycle ac. Welding ranges in amperes are: (dc) 75-175 or 125-350; (ac) 65-160 or 110-400. Rated output at 100% duty cycle: 250 amps dc at 40 volts and 300 amps ac at 40 volts.

D-250 ROUSTABOUT provides a two-in-one arrangement whereby either of two dc welding current ranges — 75-175 amps or 125-350 amps — and 1 KW of 115v dc auxiliary power are available simultaneously. Rated output is 250 amps at 40 volts, 100% duty cycle. Generator produces 10 KW of 115/230v, single phase, 60 cycle ac.

All models offered with skids or trailers. Complete specifications and prices sent promptly.

miller Electric Manufacturing Company, Inc. APPLETON, WISCONSIN

EXPORT OFFICE: 250 East 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

This process vessel for the chemical industry, fabricated by Colonial Iron Works, was welded with Arcaloy 309 Lime electrodes. The clad material is 304 on A 285 Grade C steel plate, ⅜" thick. Because of variances in thickness in the plate material, Mr. Weber deemed mild steel back up welding as impractical and costly, thus Arcaloy 309 Lime was used for the entire joint on all girth seams.

All nozzles are 304 stainless steel. Approximately 1200 pounds of Arcaloy 309 Lime were used for seam joints and nozzle fittings.

Critical welds demand the quality of

ARCALOY

STAINLESS STEEL ELECTRODES

Stainless steel or stainless clad material is used on critical applications for its corrosion resistance and high strength properties. The nation's leading fabricators specify Arcaloy stainless steel electrodes to retain these properties and to safeguard their reputation.

Bill Weber, Welding Engineer at Colonial Iron Works, Cleveland, Ohio, has relied on Arcaloy electrodes for many years because he knows he gets the quality of weld metal required for critical stainless welds. He knows that he can depend upon the quality always and in any of the more than thirty different analyses of stainless electrodes made by Alloy Rods Company. He knows that his distributor, Scott-Tarbell, Inc., can meet his requirements with "always fresh" electrodes, because they are hermetically packaged in metal to safeguard freshness and quality.

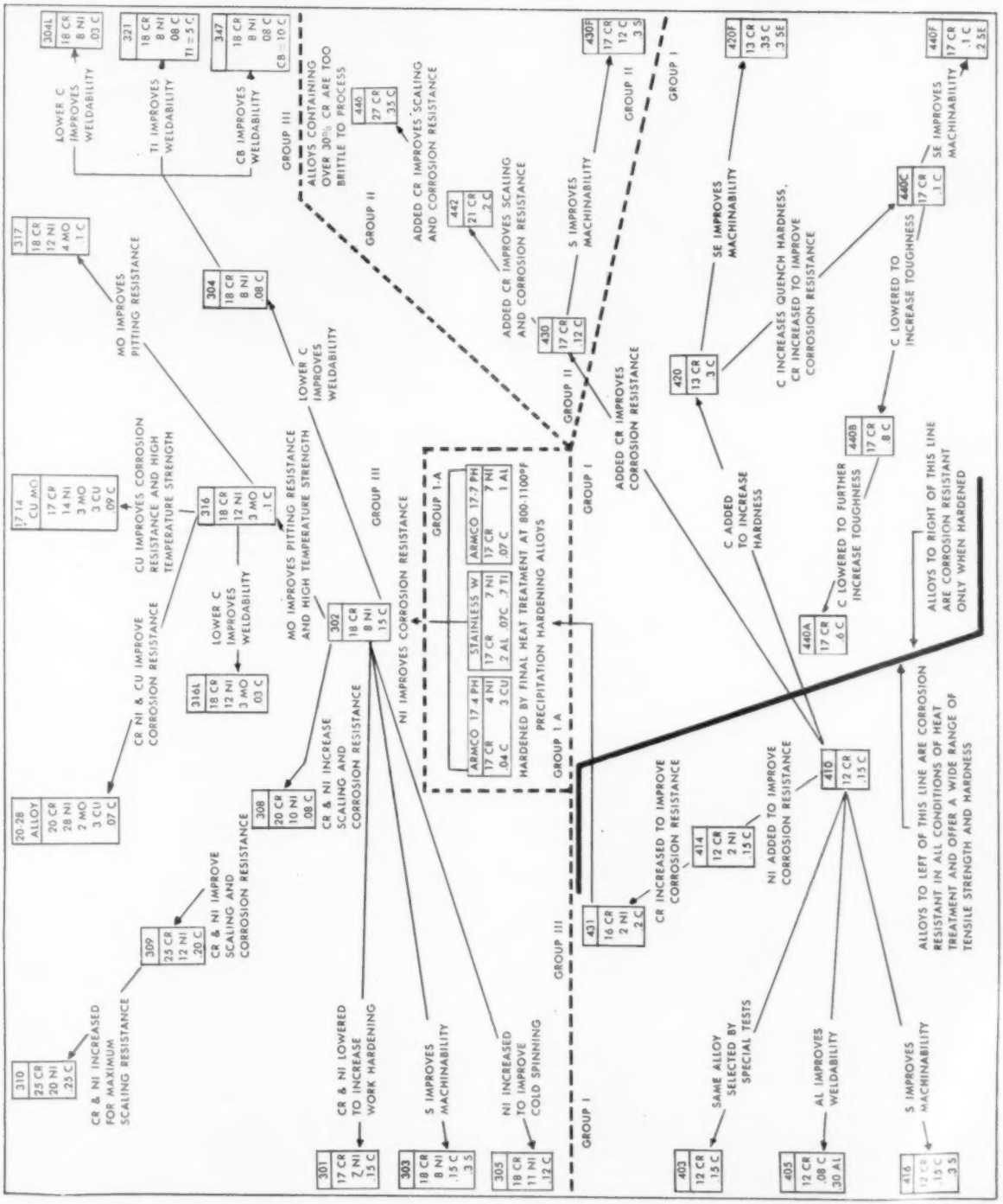
Your Alloy Rods Company representative or distributor has the knowledge and products to meet your stainless steel welding requirements. Give him a call or write direct requesting Bulletin AR-10. Alloy Rods Company, P. O. Box 1828, York 2, Penna.

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

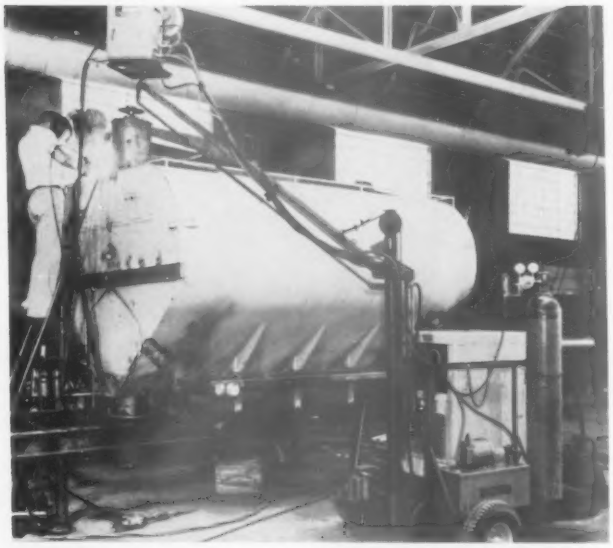
NO FINER ELECTRODES MADE . . . ANYWHERE

Relative corrosion resistance of stainless steels


GROUP I
GROUP I-A
GROUP II
GROUP III
304L 18 CR 8 NI .03 C
LOWER C IMPROVES WELDABILITY
321 18 CR 8 NI 08 C Ti = 5 C
Ti IMPROVES WELDABILITY
347 18 CR 8 NI 08 C CB - 10 C
CB IMPROVES WELDABILITY
ALLOYS CONTAINING OVER 30% CR ARE TOO BRITTLE TO PROCESS
446 27 CR .35 C
ADDED CR IMPROVES SCALING AND CORROSION RESISTANCE
442 21 CR .2 C
ADDED CR IMPROVES SCALING AND CORROSION RESISTANCE
430F 17 CR 12 C 3 S
S IMPROVES MACHINABILITY
420F 13 CR .35 C 3 SE
SE IMPROVES MACHINABILITY
440F 17 CR 1 C 2.5 E
SE IMPROVES MACHINABILITY
317 18 CR 12 NI 4 MO 1 C
MO IMPROVES PITTING RESISTANCE
304 18 CR 8 NI 08 C
LOWER C IMPROVES WELDABILITY
430 17 CR 12 C
ADDED CR IMPROVES CORROSION RESISTANCE
420 13 CR 3 C
C INCREASES QUENCH HARDNESS, CR INCREASED TO IMPROVE CORROSION RESISTANCE
440C 17 CR 1 C
C LOWERED TO INCREASE TOUGHNESS
17 14 CU MO 17 CR 14 NI 3 MO 3 CU 09 C
CU IMPROVES CORROSION RESISTANCE AND HIGH TEMPERATURE STRENGTH
316 18 CR 12 NI 3 MO 1 C
MO IMPROVES PITTING RESISTANCE AND HIGH TEMPERATURE STRENGTH
316L 18 CR 12 NI 3 MO 03 C
LOWER C IMPROVES WELDABILITY
302 18 CR 8 NI 15 C
NI IMPROVES CORROSION RESISTANCE
ARMCO 17-4 PH 17 CR 4 NI .04 C 3 CU
STAINLESS W 17 CR 7 NI 2 AL .07 C .7 TI
ARMCO 17-7 PH 17 CR 7 NI .07 C 1 AL
HARDENED BY FINAL HEAT TREATMENT AT 800-1100°F PRECIPITATION HARDENING ALLOYS
440B 17 CR .8 C
C LOWERED TO FURTHER INCREASE TOUGHNESS
440A 17 CR .6 C
C ADDED TO INCREASE HARDNESS
ADDED CR IMPROVES CORROSION RESISTANCE
ALLOYS TO RIGHT OF THIS LINE ARE CORROSION RESISTANT ONLY WHEN HARDENED
20-28 ALLOY 20 CR 28 NI 2 MO 3 CU 07 C
CR NI & CU IMPROVE CORROSION RESISTANCE
308 20 CR 10 NI 08 C
CR & NI INCREASE SCALING AND CORROSION RESISTANCE
309 23 CR 12 NI 20 C
CR & NI IMPROVE SCALING AND CORROSION RESISTANCE
310 25 CR 20 NI 25 C
CR & NI INCREASED FOR MAXIMUM SCALING RESISTANCE
301 17 CR 7 NI 15 C
CR & NI LOWERED TO INCREASE WORK HARDENING
303 18 CR 8 NI .15 C .3 S
S IMPROVES MACHINABILITY
305 18 CR 11 NI .12 C
NI INCREASED TO IMPROVE COLD SPINNING
431 16 CR 2 NI 2 C
CR INCREASED TO IMPROVE CORROSION RESISTANCE
414 12 CR 2 NI 1.5 C
NI ADDED TO IMPROVE CORROSION RESISTANCE
416 12 CR .15 C
403 12 CR .15 C
SAME ALLOY SELECTED BY SPECIAL TESTS
405 12 CR .08 C .30 AL
AL IMPROVES WELDABILITY
416 12 CR .15 C .3 S
S IMPROVES MACHINABILITY
ALLOYS TO LEFT OF THIS LINE ARE CORROSION RESISTANT IN ALL CONDITIONS OF HEAT TREATMENT AND OFFER A WIDE RANGE OF TENSILE STRENGTH AND HARDNESS

—Courtesy Peter A. Frasse & Co., Inc.

new products . . . . USE CARD ON PAGE 81



WELDING controls are carried by telescoping boom on compact carrier cart, which moves controls and wire-feed unit to weld area.

PORTABLE X-Ray unit, with plastic case and cushioned interior, can be repaired in the field manufacturer says.

Equipment cart

TELESCOPING boom is feature of carrier cart which moves welding control and wire-feed unit to weld area. Hand-operated hydraulic pump with 2½-ton capacity raises and lowers boom. It can be adjusted to heights from 4 to 14 ft, and rotated 360 deg. Hand-propelled cart, mounted on three balloon-type tires, can carry welder, water coolant unit and two standard cylinders. Provides welding flexibility, firm says. *National Cylinder Gas Div.*

Circle No. 1

Shop welder

"HUSTLER" is a new a-c transformer-type arc welder for general job welding, maintenance and repair shops. Rated at 180 amp, 25 volts on 20% duty cycle. Operating voltage is 230 volts single phase, 60 cycles, with tap for operating on low 208 line voltage when such power voltage exists. Welding and cutting current selection easy with nine receptacles arranged in circle on output panel. Ground cable plugs into one of two receptacles in center of panel for high or low range of welding current. Standard equipment includes electrode holder, plastic head shield, ground clamp, 20-ft electrode cable, 15 ft ground cable, 8 ft power connection cable and welding electrodes. *Hobart Brothers Co.*

Circle No. 2

Positioner

METALS up to ½ in. thick, in any regular configuration from flat sheet to cones or cylinders up to 54 in. OD, can be joined with new, ultra-high pressure longitudinal welding positioner. Special "Hydro-booster" unit activates two parallel continuous banks of flexible, level-seeking hold-down gripping "fingers." Piece part is positioned over mandrel, and both banks of fingers are activated. They move two edges of piece part together, and hold them in position under tremendous pressure. Positioner has 10-ft welding length with 66 in. total working space height. *Airline Welding and Engineering.*

Circle No. 3

Electrode

IRON powder added to electrode coating makes it easier and faster to operate. The "Fleetweld 7MP" is an all-position, a-c and d-c, mild steel electrode. Available in ⅛, 5/32 and 3/16 in. sizes. *Lincoln Electric Co.*

Circle No. 4

Weld units

THREE new welding units in 200, 300 and 500 amp models for a-c or d-c inert arc welding feature high frequency control which speeds striking and stabilizing the arc. Each can be set up for metallic arc a-c or d-c straight or reverse, heliarc a-c or d-c straight or reverse, automatic heliarc a-c or d-c, sigma or spot welding a-c or d-c. *A. O. Smith Corp.*

Circle No. 5

Stud welding

EFFICIENT means of stud welding sheet metal, including galvanized steel as thin as 0.020 in., has been devised using electric arc stud welding equipment without backing. There is no damage to the coating or sheet, manufacturer says. Method uses metal faced ferrule, copper alloy facing attached to ceramic portion of ferrule. *Shielded Stud Welding Co.*

Circle No. 6

X-ray unit

PORTABLE X-ray unit offers effective radiation protection, unitized design, dust and moisture-proof head. The "LX-140" has continuous range from 70 to 140 kvp. Radiographs with 2% sensitivity and 1.5 density can be produced with 1½ minute exposure through 1¼ in. of steel, according to firm. Operates from 115 volt, 60 cycle line. *X-Ray Dept., General Electric Co.*

Circle No. 7

Welding platens

SOMETIMES called "bending blocks," welding platens are in shape of huge "waffles." Used during welding and fabrication, platens set-up, clamp and bend. Special tools and accessories such as gooseneck hold-down dogs, tapered drift pins, arm clamps, etc., extend use of platens. *Acorn Iron & Supply Co.*

Circle No. 8

Hardfacing alloy

HIGHLY wear-resistant welded overlays are produced with tungsten carbide "Sprayweld." Hardfacing alloy is a powder, with tungsten carbide particles dispersed in a matrix of nickel base alloy containing chromium borides. After being sprayed on, overlay is fused to base metal to form an integral welded surface.

"No. 75" has average specific gravity of about 9.0. Melting point is 1,900 F. While in plastic state deposits can be hot-formed. The overlay cannot be forged or heat-treated. Oxidation and corrosion resistance is good, but decreases at higher temperatures. Maximum thickness as applied is about 0.080 in. *Wall Colmonoy Corp.*

Circle No. 9

Testing machine

FOR production testing of flange members on long shafts, such as axle assemblies, testing machine is hydraulically powered. It carries two dials, one showing load applied, the other is a direct reading for comparative checking. The anvil and testing ball may be interchanged to allow test impressions on either side of part. *Detroit Testing Machine Co.*

Circle No. 10

Grinding wheel

NOVEL metal center bushing on new "depressed center" grinding wheel adds extra strength and safety, maker reports. Wheels are lightweight, rigid, reinforced resinoid bonded for use on portable disc-type and right-angle type portable grinders. Made in 7 and 9 in. diameters by 3/16 and ¼ in. thick. Back and front are reinforced by resin-impregnated fabric cloth. *Chicago Wheel and Mfg. Co.*

Circle No. 11

Punch press

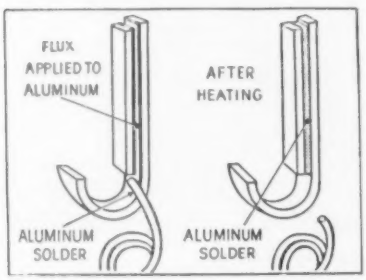
WITH bronze bearing flywheel weighing 160 lb, ample press power is assured in new 12-ton press. Crankshaft is 1¾ in. diameter, turned, ground and polished and has tension adjustable brake. Bronze main bearings are 1¾ in. diameter and 3 in. long. Clutch is single-pin, knife-type design. Can be changed from repeat to non-repeat action. Ram can be adjusted and locked. *Alva Allen Industries.*

Circle No. 12

Safety clothing

REFLECTIVE safety clothing is made of new asbestos fabric called "Silvabestos." It is said to wear 168% longer than that made of regular asbestos fabric. Protective coating gives protection against splash and heat transmission, reflects 40% radiant heat. Line includes gloves, mittens, sleeves, coats, pants, hoods, coveralls and overalls, cape sleeves, bibs and aprons, leggings and spats. Recommended for heat-treating, but should not be used in contact with open flame. *American Optical Co.*

Circle No. 13



Soldering flux

ALUMINUM solder flux is said to promote capillary action on aluminum. It joins aluminum to aluminum or to other metals. Solder may be drawn between two pieces of aluminum even when they are vertical. Operating temperature is from 600 to 675 F. Residue can be removed with water. *American Solder & Flux Co.*

Circle No. 14

I use Ranite's new plan...

for reducing excessive parts wear

You can save costly replacement of equipment parts by using the new Ranite Check-Chart system.

The *free* Ran-Check-Charts and Stickers provide an easy way for your yard and field maintenance men to periodically check part surface wear before it reaches the "wear beyond repair" condition.

Hardsurfacing with Ranite Job-Graded, Color-Coded welding electrodes renews old, worn parts and extends their surface wear-life indefinitely. Because of its faster deposition rate, higher recovery and more area coverage per pound of rod, Ranite is more economical to use.

Get your free Ran-Check-Charts and Stickers from your local Ranite distributor or write direct today.

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Ranite
HARDSURFACING RODS

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The Standard

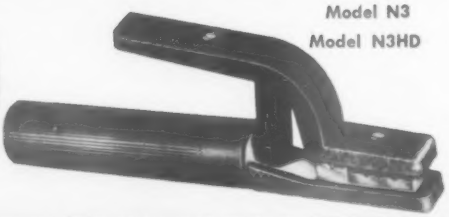
The NEW DUROGON

The Standard DURO Holder

Standard

Perfect Balance • Easy Replacement of Parts • The Long Jaw makes the hard to get at places easily accessible. After 26 years of proven performance these features make the DURO Standard still the Preferred Holder.

DURO'S *NEW* Holder The Durogon



Model N3
Model N3HD

Model N3 New alloy, high tensile strength, light-weight aluminum body.
Long Life Copper Alloy renewable jaws.
Extremely cool operation. Fully Insulated.
Jaw Insulation resists high temperature.
All parts quickly replaced using only a screwdriver.
Rugged Heavy-Wall Fibre Grip.
Solderless Type, proven cable connection.

Model N3HD Recommended for Heavy Duty continuous service.
All the features of the Aluminum model Durogon, but this body is made of rugged high conductivity bronze for super conductivity and choice of mechanical, soldered or brazed cable connection.
In addition, this heavy duty model has an extra long, heavy-wall fibre grip.

Write for literature and name of nearest distributor.

DURO ENGINEERING COMPANY
51 OREGON AVE HAMDEN CONN

Measuring instrument

DEW point of gases from room temperature to minus 80 F can be measured with line of portable, self-contained instruments. The "7200" is equipped for measuring dew point of gases under pressure. It can be used on gas pipe lines, compressed air lines, instrument air lines, bottle gas, etc. When gas source is under pressure, use of the "7200" avoids necessity for hand pumping for purging and adjustment of pressure ratio. *Illinois Testing Laboratories, Inc.*

Circle No. 15

Sweat band

BAND made of a spongy material absorbs sweat from the forehead, keeps it from fogging glasses or goggles. Dipping band in cold water before using increases effectiveness. *Sellstrom Mfg. Co.*

Circle No. 16

Beam clamp

LOCKING grab is for use on I beams, H beams, channel iron and angle iron, and for attaching chain falls and other portable hoists. Portable beam clamp can be furnished for attachments to flange sizes 1½ to 14 in., in 1 through 10 ton sizes. Can be placed on beam and locked in position in less than one minute, firm says, and dismantled as quickly. *Renfroe & Sons, Inc.*

Circle No. 17

Crack detector

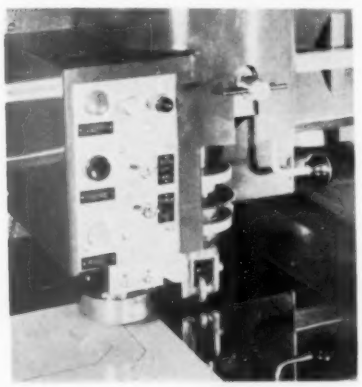
PORTABLE crack detector is based on principle of magnetic particle inspection. Will locate and outline any surface crack or fault on any ferrous casting. Unit will spot fine hair-line cracks invisible to eye. Weighs 20 lb, and can be operated from either 110 a-c line, 12V or 6V battery. Added versatility makes crack inspection possible in areas where electrical lines are unavailable or not permitted. Not affected by humidity or temperature. *U.S. Casting Repair Corp.*

Circle No. 18

Helmet

COMBINATION welding helmet-sound protector has elongated type ear domes which protect against high and low frequency noises. Vinyl sponge ear seals fit securely and neoprene-covered spring headband is attached to sides of helmet by friction joints. For safety, conversation and signals are audible. Fiber glass helmet comes with white or dark gray exterior sheet which is moisture-proof and well-ventilated. Unit is fireproof and rustproof. *American Optical Co., Safety Products Div.*

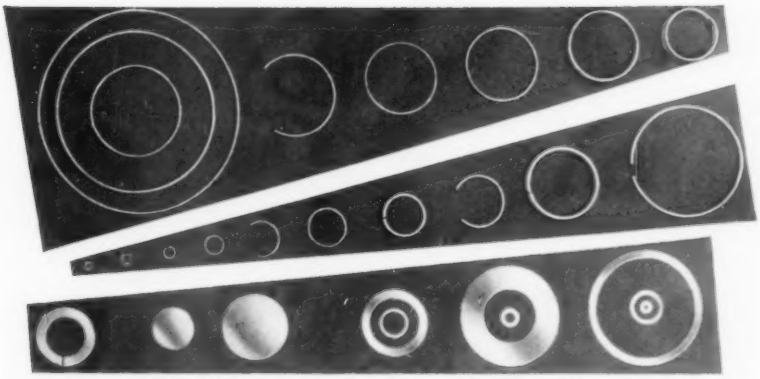
Circle No. 19



Electronic tracer

FLAME shape-cutting machines can be steered with new electronic line tracer. The unit — an adaptation of newly-developed optical "sensing" systems — directs metal cutting torches by scanning ordinary pen or pencil line drawings. Eliminates need for templates, firm says. Simple drafting-room pencil drawing 40/1000 inch wide can be followed. Device turns corners on radius as small as 3/32 in., and will cross lines. Not sensitive to other light sources. Consists of vibrator-type scanner employing photo-transistor. *National Cylinder Gas Div.*

Circle No. 20



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GB *PRE-FORMED* Silver Brazing Alloys are available in the size and shape your job requires. Pre-formed shapes, like those shown, are designed for the joint. They assure strong, safe connections with a measured, minimum amount of alloy to save you time and money.

Write today for facts about efficient, economical GB 88 Flux and GB Silver Brazing Alloys in random coils, strip, pre-formed rings or special shapes.

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Take the toughest snagging operation you can find, add fast-cutting, cool-running Atlantic Grinding Wheels, and watch your grinding costs flatten out to a money-saving minimum. Made with a special resinoid bond to withstand high centrifugal forces, these work-proved wheels have a smooth, floating action that speeds up grinding . . . gives you cleaner surfaces with fewer passes.

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NAME_____

POSITION_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Fastener

For economical installation of single-sheet, non-insulated corrugated metal walls and roofs, a new stud-welded fastener, the "Set-lock," has been designed. Corrosion-resistant stainless steel studs are furnished for corrugated aluminum sheeting, while plated mild steel studs are used for corrugated steel. *Nelson Stud Welding Div.*

Circle No. 21

Weld torch

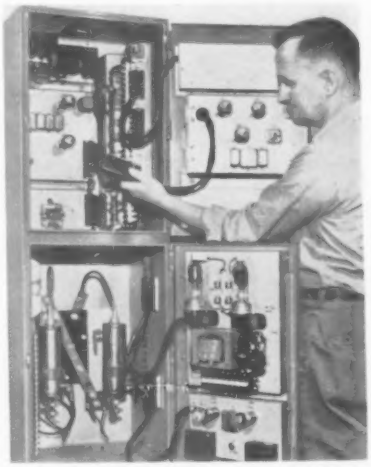
Flick of thumb will turn off and on a new welding torch, once the operator has adjusted it to his liking. It is especially engineered to improve efficiency and comfort of operator. Fuel flow controlled by light pressure on thumb lever, from pilot flame to work adjustment where lever locks in position. Flick of lever returns flame to pilot. Made in three models for light or medium welding. *Dockson Corp.*

Circle No. 22

Metal remover

Wide variety of metal removal jobs can be done with new "H-3" torch. Designed to use up to $\frac{3}{8}$ in. diameter electrodes, torch directs compressed air through two orifices in adjustable head. Air supply controlled with push button on-off valve in torch handle, which remains in either position once depressed. Molded plastic, high impact insulators guard the head and jaws of the "H-3." *Arcair Co.*

Circle No. 41



Welder control

Non-synchronous electronic combination welder controllers break down control into individual panels for sequence timing, power supply, valve operation and contactor firing. Combination control with 600 frame contactor has provision for either 200 or 400 amp QMB fusible disconnect switch, either 3B or 5B timer, either tube or relay control of air valve and either tube or relay firing of ignition contactor. *Square D Co.*

Circle No. 23

Cutting tips

Two-piece cutting tips for use with LP gases are designed to get maximum cutting efficiency from use of petroleum, natural and city gases. One type is for general hand cutting, a second for fast preheating and general cutting and a third for speed tip machine cutting. Sizes from 00 through 8. *Victor Equipment Co.*

Circle No. 24

Manipulator

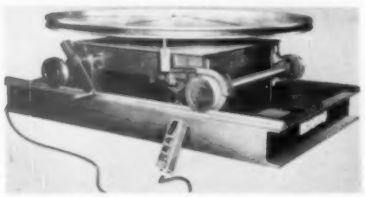
ROLLER cluster grips three ways in new welding head manipulator, giving alignment throughout operation. Manufactured in full range of sizes from 6 by 6 to 12 by 12, the automatic welding head manipulators have maneuverable and compact control units. *Worthington Corp.*

Circle No. 25

Clamp

By pulling clamps out to desired location, new all-purpose clamp is quickly positioned. Self-aligning pad on top jaw takes up irregularities in the material being held. Jaws do not mark either ferrous or nonferrous materials. With its 3⅝ in. and 0 to 1¼ in. extent of jaws, and 1½ in. throat depth, clamp can be used with standard clock gage for inspecting small parts. *Research Engineering and Sales Co.*

Circle No. 26



Positioner

MATERIALS to be drilled and tapped can be positioned with new "FT75CS" positioner with load capacity of 75,000 lb. The 72-in. diameter 8-slot table is 2½ in. thick with 1 deg increment marks at periphery and indicator to establish degree of rotation. Movable base, powered by ¾ hp gear motor, is equipped with camlock handle to secure positioner on track during set-up and drilling operations. Control station is on 110-volt safety control circuit with 20 ft remote control four-button station. *Aronson Machine Co.*

Circle No. 27

ONE WELD--
or a Thousand Miles of Them

Magnaflux inspection of weld on refinery reactor during erection.

Speed and ease of Magnaflux speeds pipeline weld tests, and tests 100% of welds!

To get fast--positive--low cost inspection

Call MAGNAFLUX
NATION-WIDE
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Anywhere--Anytime

When you need weld inspection you can depend upon — in the field or in your plant — *call us.* You'll have a Magnaflux factory-trained Commercial Inspector or team on the job — pronto!

These expert men, working with all Magnaflux Test Systems (Magnaflux-Magnaglo, Zyglo, Sonizon Ultrasonic and others), and with Gamma Ray, find every defective weld that *needs* to be found.

The cost — usually a few cents or less per foot of weld! It is just as important to you that they recognize *good* welds as spot the bad ones.

Then, by showing not only *what* and *where,* but *how* defects occur, they help welders do a better job. This cuts your welding costs — assures consistent quality at a practical price.

FOR TESTING BIG THINGS such as pressure vessels, heavy machinery, piping and pipelines, structural members, *Magnaflux Field Inspectors* brings a mobile "shop" right to the site.

IN THE FIELD OF NUCLEAR ENERGY, this test service offers the most positive detection known for locating the weldment leaks that are of such vital concern. In any kind of maintenance inspection Magnaflux Test Systems mean safety.

FOR SMALL PARTS WELDMENTS, use your nearby *Magnaflux Commercial Inspection Plant.* Testing here is low in cost for any quantity—gives you the benefit of a *nation-wide standard inspection* that helps you build welding business through accepted evidence of quality. Write for new bulletin.

TO GET, USE OR BUY BETTER WELDING AT LOWER COST — write for details . . . or call any of the COMMERCIAL INSPECTION BRANCHES SHOWN BELOW

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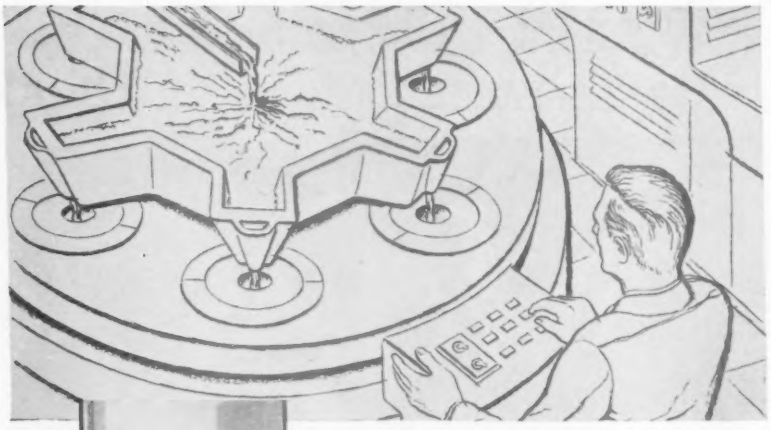
Newark 4, N. J. HUmbolt 3-1235	Pittsburgh 36 TUxedo 2-3448	Indianapolis 18 LIberty 7-1303	Houston 21 WAlnut 3-9169
E. Hartford, Conn. BUtler 9-2737	Cleveland 15 HEnderson 2-0727	Chicago 39 EVergIade 4-1561	Oakland 8 Olympic 8-0201
Bridgeport, Conn. EDison 6-2113	Cincinnati 23 MUlberry 1-6436	Los Angeles 22 RAymond 3-8961	Van Nuys STate 5-8640



Spectographic analysis assures strict adherence to specification.

Homogenized brazing alloys cut production costs!

New continuous casting of United Phoson and Sil-Bond alloys now results in the most uniform — homogenous — brazing alloys available. This technique assures more uniform results, speeds up production, reduces finishing requirements . . . for you! Always specify United homogenized alloys . . . certified to meet all standard specifications.

Complete information, and colorful new 8 page booklet "Low Temperature Brazing Engineering Facts and Data" are yours for the asking.
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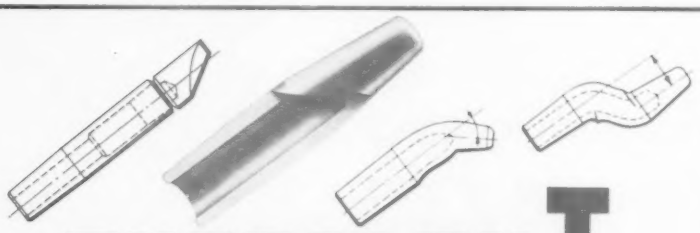
Specify **UNITED** *for brazing alloys ... aluminum, brass, copper tube and wire*



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Resistance Welding Alloys

- **SPOTWELDING TIPS, a complete line** . . . R.W.M.A. Standard Tips, 'Tuffcap' Standard Tips, Cold-Formed Tips, Copper-Tungsten Faced Tips and many "Specials", all *carried in stock* in a wide selection of active types and sizes.
- **BAR STOCK,** round, hexagon, square and rectangular.
- **FORGINGS,** a large stock of bars and wheels available for finishing. Special forgings to order, rough, or finish-machined.
- **WELDING TIP HOLDERS and ADAPTERS**

You too may depend on *Tuffaloy*, with its record of over twenty years of prompt service and consistently high quality.

See your nearest AIRCO or TUFFALOY representative.

Ask for Catalog and Price List.

AIRCO®

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.

Welder

LIGHT, small 250 amp welder has "twist of the wrist" current control, manufacturer declares. Welder features high efficiency transformer with tape wound core, and no laminations. Fan-cooled, it has individual current and thermal overload protection. Portable, welder weighs 112 lb and handles electrodes from 1/16 to 3/16 in. Duty cycle is 50%. *Brennen, Bucci & Weber, Inc.*

Circle No. 28

Tensile tester

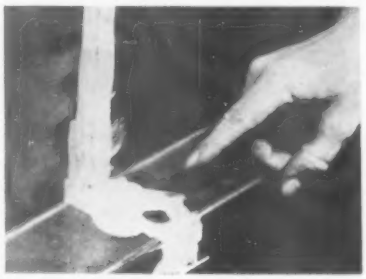
SPECIMENS up to 5 ft long can be tested with new tensile tester which features a self-contained, electrically driven power unit and long bed. Machine can be set to test for any load up to 10,000 lb, maximum developed by hydraulic cylinder. Can handle rope, cable, wire, etc. *Detroit Testing Machine Co.*

Circle No. 29

Electrodes

BOTH steel plate and electrodes used in its fabrication are from the same source, manufacturer says. New line of welding electrodes, called "Plate-Mate," makes it easy to select the proper electrode for each of 50 types and grades of alloy, alloy-clad and carbon steel. *Lukens Steel Co.*

Circle No. 30



Dye penetrant

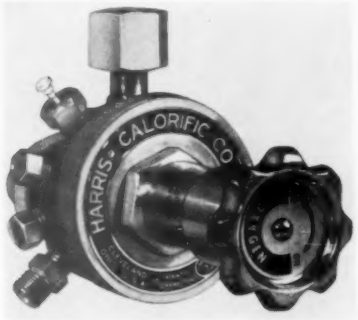
SPRAY-CAN dye inspection method for locating cracks, seams, porosity and other defects open to surface in almost any solid material is available in non-flammable or high-flash-point formulas. Made with chlorine-free formulations, can be used to test machinery parts almost anywhere in plant or field. Available in 12-oz. pressure-spray cans, in quart, gallon and 5-gal cans and in 55-gal drums. *Magnaflux Corp.*

Circle No. 31

Wrench holder

TEN or more wrenches of various sizes can be carried in a new "Co-Ma-Co" wrench holder. Holder clamp slips off-center for quick removal or replacement of any size wrench carried in the aluminum holder. Weighs only ½ oz and sells for $1.50. *Contour Marker Corp.*

Circle No. 32



Gageless regulator

DESIGNED to reduce maintenance costs brought about by broken gages, inlet stems and adjusting screws, a new gageless regulator is for field applications. Called the model "77," regulator has protruding cylinder content indicator which records full, ¾, ½, ¼ or empty, when flush with outer container. Pressure indications are embossed on bonnet, and adjusting screw is turned in until thimble attached is placed on specific pressure required. Connection stem is short to reduce breakage. Tank connection nut supported over stem to prevent damage to inlet connection seat. Safety valves protect pressure stages *Harris Calorific Co.*

Circle No. 33

Arc time meter

NEW "Arc-timer" will record duration of arc of any welding machine, a-c or d-c, whose open-circuit voltage is not over 110 volts, manufacturer says. Meter is cumulative so arc operation between 15 and 45 volts may be recorded by job, hour, week, etc. Unit is designed to facilitate machine performance analysis, operator duty cycle and time and motion studies. "Arc-timer" is 6-in. long, 5-in. wide, 4-in. deep and weighs 4 lb. *Machinery & Welder Corp.*

Circle No. 34

THEY LOOK ALIKE...

BUT THERE'S A BIG DIFFERENCE INSIDE

. . . AND INSIDE ACETYLENE CYLINDERS THE BIG DIFFERENCE IS COYNE'S NEW, FASTER-FILLING, MORE ABSORBENT FILLER. LET US PROVE YOU'LL START SAVING WHEN YOU START USING COYNE ACETYLENE CYLINDERS.

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3017 BAR

322 STICK

321 POWDER

— PLUS —

DRYGALV which requires no heat!

Can be applied as easily as a paint by brush or spray. Dried film is 95% metallic zinc, thus it will afford the same cathodic protection as galvanizing.

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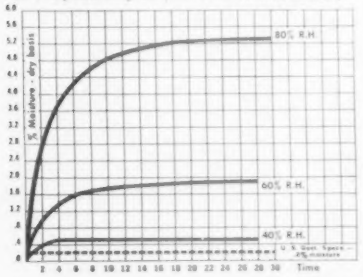
HERE MINUTES MEAN DOLLARS TO YOU!

MOISTURE ABSORPTION OF LOW HYDROGEN-TYPE ELECTRODE COATINGS

80° F dry bulb temp. 80%, 60% & 40% relative humidity.



The moment you unpack a mineral-coated electrode, it begins to absorb moisture. As the chart shows, rods can pick up as much as 13 times allowable moisture content within two hours!

DryRod OVEN

DRY-ROD Oven costs only a few cents a day to operate. Storing unpackaged rods in it preserves the original quality of the electrodes . . . protects you against the wastes and dangers of defective welding caused by moisture-absorption. DRY-ROD Ovens are built for heavy duty—completely wired, ready to use. 3 sizes. *New literature now ready. Write*

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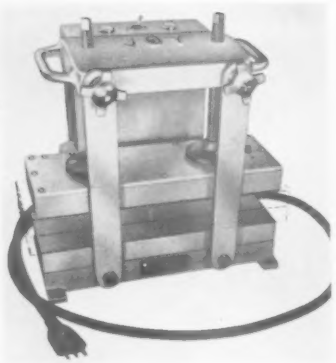

Molding presses

To reinsulate and rejacket natural and synthetic rubber and thermoplastic covered cables, a new line of molding presses are said to accommodate all standard cable types and sizes through the use of interchangeable aluminum molds. Presses carry a 3,000 watt rating and are available for operation on seven standard a-c and d-c voltages. Heat from four replaceable strip heaters is applied through molds to areas being vulcanized at molding pressures of up to 25 tons. Twin tie bars can be dropped for front loading and permit using press to create Y and T splices. Vulcanizers are 18⅛ in. long by 18¾ in. high and 13 in. deep. They accommodate rectangular shaped molds up to 6 by 6 by 24 in. and can be used end to end for making longer cable repairs. Weight, less molds, is approximately 85 lb. *Joy Mfg. Co.*

Circle No. 35

Brazing alloy

HIGH-temperature service brazing alloy "Nicrobraz 150," is a nickel-base material containing chromium borides suited for use in fabricating turbine blades, rotor shafts and high-stressed sheet metal structures. Available in powder, rod, paste or plastic bonded wire. Alloy resists oxidation to 1800 F. Joints are ductile, permitting 720-deg twist without fracture. Joint strength is about 34,000 psi tensile shear. Recommended for furnace brazing in either pure dry hydrogen or in vacuum atmosphere. *Wall Colmonoy Corp.*

Circle No. 36

Overload device

SAFETY overload device protects high speed presses and dies against misfeed or doubling of material, firm says. It does not operate on amperage overload or vibration principles. Will not permit more than two thicknesses of material to enter the die at the same time. *Precision Welder & Flexopress Corp.*

Circle No. 37

WHY AIRCO® TUNGTUBE?

because it gives you

TOP RESISTANCE TO SEVEREST ABRASION

* Airco Tungtube electrodes are pure tungsten carbide — next to diamonds, the hardest commercial material known.

* Tungtube is outstanding for use in hardfacing grinding wheels, drill bits, metal working machinery . . .

Airco Tungtube comes in screen sizes 10-20, 20-30, 30-40, and 30-down. In both bare rod and coated form. Accepted as standard for cutting non-metallic substances such as coal, shale, and granite.

FREE — Send for the handy Airco Electrode Guide. It will help you select the right electrode for your specific job. Request catalog 1318.

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AIR REDUCTION SALES COMPANY
A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

Toggle clamps

HOLDING pressure of 1,650 lb is a feature of a new family of toggle clamps with forged alloy steel base, replaceable components, serrated hardened bushings and staked rivets at all pivot points, a 6 13/16 in. holding bar and ¾ in. sq cold-drawn bars and handles.

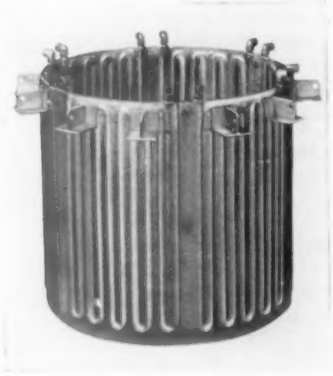
Clamps are available in two series of four models each. Series 527 is the low-silhouette-handle-type, good when overhead work-clearance is a factor. *Detroit Stamping Co.*

Circle No. 38

Gear press

PRESS work done high up on the stroke can be done with a welded steel, double back geared, 4-point eccentric gear press. Features include: capacity of ½-in. from bottom of stroke of 300 tons, steel tie rod type frame, distance between gibs of 137 in., slide area of 90 by 135 in., with stroke of 18 in. Press operates at 14 strokes per minute. Equipped with a pneumatic clutch and brake with electrical clutch control, it requires approximately 96 by 190 in. of floor area and weighs about 192,000 lb. *Federal Machine and Welder Co.*

Circle No. 39



Radiant shield

TWO embossed sheets of stainless steel, welded together to create flow channels for a coolant, form panels to make a radiant shield for electric and other high temperature furnaces. The panels, in the form of a vertical cylinder, form the heat enclosure that will not melt and which eliminates pipe coils, tube coils and ceramic refractories.

Shield of any required size can be made by combining the needed number of panels. One of the metal sheets can be stainless steel and the other sheet mild steel—or another weldable metal. *Dean Thermo-Panel Coil Div., Dean Products, Inc.*

Circle No. 40

"YARD WORK" done the easy way . . .

H & M pipe beveling machines mean speed and accuracy on ANY size of pipe!

H&M Pipe Cutting and Beveling Machines offer the easiest, quickest and most efficient solution to preparing pipe for welding, even by untrained operators.

One man can handle and operate **any size** H&M machine — any of the 7 H&M models handling from 1½" to 36" pipe — after only a few minutes of instruction — **and be assured of perfect cuts or bevels every time.**

The split-horseshoe gear of H&M machines, plus their extreme lightweight, permits the operator to slip them easily over the next section of pipe **and within a matter of minutes** the cut or bevel is finished, accurate and true.

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PIPE BEVELING MACHINE COMPANY
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BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

SAFETY
ECONOMY

HI-AMP®
GROUND CLAMPS

- Spring cannot be knocked out.
- Spring adjustment screw for easy replacement or adjusting.
- Sturdily built for excessive abuse.
- Designed especially for all-around welders needs.

LENCO, INC.
Box 189, Jackson, Mo.

SMITH'S

BIG 98

WELDING AND CUTTING OUTFIT

Complete—nothing else to buy

ONLY **$98.00**

Slightly higher in Canada

- Welds up to 3/8" with tips included.
- Cuts 1" steel (up to 4" with optional tips).
- Slip-in tips seat perfectly by hand—no wrench needed.
- Exclusive "Flo-Trol" diaphragm protects against back-fires; eliminates seat burn out.

Each set is packed in "easy carry" carton. Contains everything needed.

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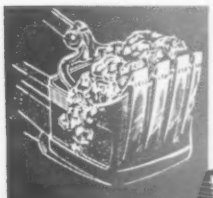
SMITH WELDING EQUIPMENT CORPORATION
2633 FOURTH STREET S. E. • MINNEAPOLIS 14, MINNESOTA
Our 40th Year



bucket teeth wearing too fast?

MANGANAL
T. M. REG. U. S. PAT. OFF.

11% — 13½%
MANGANESE-NICKEL STEEL

WEDGE BARS

minimize impact & abrasive wear!

- Workhardens to 550 Brinell
- Practically eliminate build-up welding
- Put buckets back on the job with maximum efficiency.

Write for complete details

SOLE PRODUCERS

NEAREST DISTRIBUTOR ON REQUEST

STULZ-SICKLES CO.
PORT AVENUE AT JULIA ST., ELIZABETH, NEW JERSEY

NATIONAL WELDING EQUIPMENT ASSOCIATION MEMBER

NEWS . . . . . *from page 8*

was first shown publicly at the American Management Association's packaging exposition at the New York Coliseum.

Sealed packages are airtight, are resistant to all penetration but puncture or tearing. The 100-watt welder uses no heat, flame, solder or flux and has been tested on aluminum foil to 0.0003 in.

Bring barge to cargo

So three bulky pieces of all-welded steel need not be transported through the plant to the regular river loading dock, U. S. Steel's American Bridge Div. pulled a barge out of water and secured it on the bank of the marine ways at the Ambridge, Pa., plant. The three welded pieces make up the superstructure of a bulkhead hoist to be erected by a contractor for the U. S. Corps of Engineers at the Hildebrand Lock and Dam on the Monongahela River, six miles north of Morgantown, W. Va. To facilitate field erection, the superstructure was built in only three sections, despite the fact that it is 60 ft high, 108 ft wide and 16 ft deep. A locomotive crane lifted the three sections into the barge, it was relaunched and sent on its way.

American Welding men save Air Force dollars

American Welding and Mfg. Co.'s engineers were cited for "an amazing reduction in weight and cost per unit" in the manufacture of structural flash butt welded rings of commercially pure titanium used in the component assemblies of J-57 and other jet engines.

At home show

ATTENDING a recent Miami County Home Building show in Troy, Ohio, were (left to right), Troy Mayor O. S. Metcalf, E. A. Hobart, president of Hobart Brothers Co. and Ohio Governor C. William O'Neill.

REAR Admiral E. J. Peltier and Caterpillar President H. S. Eberhard.

Navy lauds Caterpillar for "Deep Freeze" work

A Certificate of Merit, the Navy's highest award to civilian organizations, was given to Caterpillar Tractor Co., Peoria, for developing and manufacturing specialized tractors, arc welders, etc., for "Operation Deep Freeze," an exploration and construction mission in the Anarctic, part of the International Geophysical year.

NCG builds oxygen plant

The National Cylinder Gas Div. of Chemetron Corp. recently started construction on a new $3 million liquid oxygen, nitrogen and argon plant near Philadelphia. It will provide a direct pipeline supply of oxygen for the new H-iron process of iron powder production at a Conshohocken, Pa., plant of Alan Wood Steel Co. Site is adjacent to NCG's present plant. The new plant's initial production capacity will be more than 65 tons of liquid oxygen, nitrogen and argon per day.

Iowa weldors hold seminar

The Jim Gossman Shop in Spencer, Ia., was the scene of a recent welding seminar sponsored by Locals 202, 175 and 184 of the Iowa Blacksmiths and Weldors Association. Live demonstrations and films were featured.

ISA devises code for panel tubing

A color code for panel tubing has been established by the Instrument Society of America. The Society recommends uniform color coding of pneumatic tubing on instrument panels. The code urged for industry adoption is: air supply-red, seal-purple, set-black, alarm-green, read-out-blue, transmitted-orange, control-led-yellow, all other-natural.

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AIR LP-GAS

SOLDERING TORCH KITS

Ideal for:

Plumbers
Refrigeration and air conditioning work
Electricians
Auto repair
Tile layers
Many others

Set is packed in handy metal carrying case. Note new compact pre-set LP-Gas regulator.

Provides economical heat for many jobs

Burns air and LP-Gas only . . . assures hottest, most efficient and economical flame possible with comparable equipment. Use for soldering, light brazing, general heating, etc. Features Slip-in tips that seat by hand; foolproof pre-set regulator; many accessories. Adapts easily for use with acetylene.

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HEAVY DUTY
PUNCH PRESSES

Powerful
Dependable and Economical
Fully Guaranteed
Moderate in Price

Hundreds of Different Model Combinations 1 to 12 Ton Capacities

See your Supply Dealer or write for Catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

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Aronson TracTred (T. M. Reg.) Turning Rolls for thin-walled heavy cylindrical work to 27 tons capacity. Zero to 100 IPM turning speed and Built-In Grounding.

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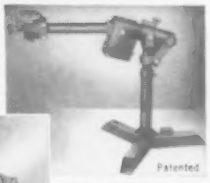
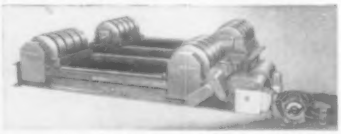
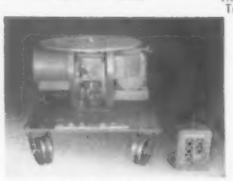


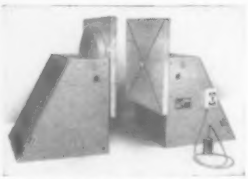


Heavy Duty Precision Built Rubber and Steel Tired Turning and Pipe Rolls, 100% overload protected. Capacities to 600 Tons.

Fully Automatic Gear Driven Positioners, featuring Geared Elevation, 135° Tilting and Variable or Constant Speed Rotation. Capacities to 350,000 lbs.



Model D Gear Driven Positioners. Compact. Precise. Rugged. Capacities to 1000 lbs.



Rugged Head and Tail Stock for positioning bulky weldments between centers. Table Backup for Zero Deflection. Magnetic Braking. Capacities to 160,000 lbs. Geared Elevation Optional.

Heavy Duty Floor Turntables with precision speed control and Magnetic Braking, used for welding, burning, X-raying, etc. Capacities to 120,000 lbs., various heights and speeds.

Bench Turntable Automatic Positioners with Mercury Grounding. Capacities to 500 lbs.

Quality POSITIONERS by **Aronson MACHINE COMPANY**
ARCADE, NEW YORK

YES! 2 ELECTRODE INVENTORY for ALL STEEL WORK

IN STEEL You Can Be Ready for Anything! . . . Production or Emergency Repair with ALL-STATE 2 ELECTRODES!!!

Pair-up No. 275 with STEELARC®

Easiest Steel Electrode to Use and nearest to a "one rod supply for mild steel welding." Enables pass on pass without wire-brushing or chipping.

Master Craftsmen say:

"Weld anything in the steel field with All-State No. 275 and get highest tensile of any rod on the market." This chromium-nickel electrode is considered by many to be their "problem-solving rod" for all steels that are normally hard to weld.

IMPORTANT FEATURES OF BOTH NO. 275 and STEELARC®

Both AC-DC. Both low, low amperage—starts at 40. Both especially coated to transfer less heat into base metal. Both deposit faster— speed up production, get the job done sooner, do away with a lot of warpage. Both are top-o-the-heap for work on steel.

With these and other advanced All-State Alloys
GOOD WELDORS DO BETTER

Select right alloy,
Use it right,
Do your best work on **STEEL**

Pocket size folder tells how
Ask your Welding Supply Dist. or write for STEEL FOLDER

Alloys and Fluxes for joining ALL METALS ALL METHODS
TORCH WELDING
SOLDERING · FILLING · SEALING
TORCH BRAZING
FURNACE BRAZING
ARC WELDING

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

MIT offers program on X-ray diffraction

A special summer program in the metallurgical applications of X-ray diffraction is being offered by the Massachusetts Institute of Technology from August 18 through 29. Methods of using X-ray to study problems of physical metallurgy and recent progress in their application will be discussed.

ASTE banquet honors six tool men

The American Society of Tool Engineers honored six men at the 1958 National Honor Awards Banquet held recently in Philadelphia as part of the 1958 Tool Show and Meeting. Award winners were: Lester L. Colbert, president, Chrysler Corp.; Jesse Daugherty, staff vice president, engineering, Giddings & Lewis Machine Tool Co.; J. Everett Hollingsworth, dean of business and technology, Long Beach City College; Dr. Max Kronenberg, consulting engineer, Cincinnati; Andrew E. Rylander, technical editor of *Western Machinery & Steel World* and Dr. Milton C. Shaw, professor, Massachusetts Institute of Technology.

Student AWS chapter

RICHARD C. WILEY of California State Polytechnic Institute and educational chairman of the AWS Los Angeles section presents a plaque and banner to William Chitwood, secretary and Miss Colleen Gill, treasurer of the new Taft Student Chapter of the American Welding Society. It is one of the country's first student chapters and the first to be sponsored by the Los Angeles section.

Wheelabrator provides graduate study grant

A $100,000 education grant offered by Wheelabrator Foundation was announced at the recent Foundry Educational Foundation conference in Cleveland. Fifty fellowships of $1,500 each will be distributed during the next 10 years; the remainder of the grant can be used by FEF for fellowships or scholarships. FEF promotes education in foundry science, engineering and operation.

COMING EVENTS

SEPT. 8-10: Canadian Section, Compressed Gas Association meeting, Seigniory Club, Montebello, P.Q., Canada.

OCT. 27-31: 1958 National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland.

JAN. 26-29: Plant Maintenance and Engineering Show, Cleveland Public Auditorium, Cleveland.

APRIL 7-10: 1959 AWS Welding Show, International Amphitheatre, Chicago, Ill.

Rockefeller Foundation extends solar research

A $250,000 grant from the Rockefeller Foundation will enable the University of Wisconsin to continue its solar energy program for another three years—to June 30, 1962. Research is directed toward finding methods of utilizing the energy of sunlight.

Ship first nuclear zirconium to AEC

The Atomic Energy Commission received its first lot of nuclear-grade zirconium sponge recently from Columbia-National Corp., Cambridge, Mass. Because of its nuclear and physical properties, zirconium is used extensively as a cladding and structural material in reactors. Much of the metal will be used in construction of reactors for the Navy's atomic powered fleet.

Distributor appointments

Heath Engineering Co., Ft. Collins, Colo: F. V. Schilling, Royal Oak, Mich.

Machinery & Welder Corp., Chicago: R. W. Holliday Associates, Pittsburgh; Kirk Wiklund & Co., Kansas City, Mo.; Norco, Inc., Boise, Idaho.

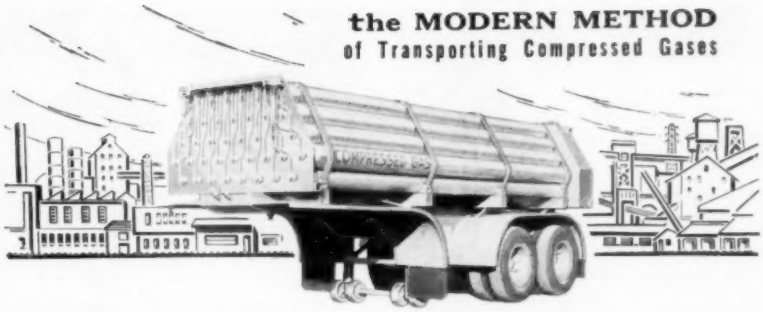
NCG Div., Chemetron Corp., Chicago: Northern Welding Supply Co., Jackson, Mich.

Precision Welder & Flexopress Corp., Cincinnati, Ohio: Heck & Co., Inc., Chicago; Zimmerman and Gammond, Inc., Park Ridge, Ill.; Howard Gordon, Lancaster Pike, Pa.

Thermacote Co., Pasadena, Calif.: F. V. Schilling, Royal Oak, Mich.

Unique Equipment, Inc., Brooklyn: Anderson Equipment Co., Los Angeles.

United Specialities, inc., El Dorado, Ark.: Case and Gibson, Charlotte, N.C.; John B. Wiley, Los Angeles; and George H. Davison, Marietta, Ga.



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- CHASSIS — by leading Chassis Manufacturers with Service Branches throughout the United States for YOUR Convenience.

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CYLINDERS AND GAS PRODUCING EQUIPMENT
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IN THE RED DRUM

HIGHEST QUALITY

DUST FREE

DEPENDABLE SUPPLY

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Yes, actually a BOYCE Centering Head replaces

- ✓ The Protractor
- ✓ The Centerhead
- ✓ The Center Punch
- ✓ The Level
- ✓ The Scale

Determines Center Line at any Degree and Measures Degree of Declivity

Weighs only 9 ozs. Pocket size.

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

BOYCE CENTERING HEAD

30 YEARS AGO

(Taken from *The Welding Engineer* of July, 1928)

The article "Aircraft Welding Standards" claims that steel ships have marked advantages over original wood and wire types. In fabricating aircraft for the Army and Navy, welding was adopted only after exhaustive tests proved its worth.

—30 YEARS AGO—

It will cost a fourth as much to send the average business or social letter by air mail after August 1. The rate will be reduced from 10 cents for ½ oz to 5 cents for the first ounce and 10 cents for each succeeding ounce. The new low rate holds tremendous possibilities for the American business man. (Thirty years later—August 1, 1958—rates are on the upswing again. Air mail will be 7 cents an ounce.)

—30 YEARS AGO—

A ferrule, welded 15 centuries ago, was unearthed at the site of the Roman city of Uriconium in England, which flourished until A.D. 380. It proves not only that the Romans were able to join iron, but that they could join two pieces of iron with copper—the forerunner of modern brazing.

—30 YEARS AGO—

Charles Haines, vice president in charge of engineering of the Keith Dunham Co., Chicago, sailed on the Aquitania June 21 for an extensive engineering trip in Europe.

—30 YEARS AGO—

Elmer Smith, Smith Welding Equipment Corp., was elected 2nd vice president of the Gas Products Association at its 14th annual meeting which was held at Hot Springs, Va., July 10-13. Stuart Plumley was elected secretary. Among the "good" golfers present were H. S. Card and F. R. Fetherston who took first and second low net prizes, respectively.

—30 YEARS AGO—

Among those attending the CGMA summer meeting at Seaview Golf Club, Absecon, N. J., June 21-23 were: John J. Crowe, Air Reduction Co., Allen Renton, Hawaiian Gas Products Co. and Franklin R. Fetherston.

- Delivery pressure is constant—regardless of line pressure.
- Seat mechanism and filter are easy to reach — using only one wrench.

- Nylon fabric insert reinforces long-life molded-rubber diaphragm.
- Large effective area of diaphragm assures high performance.
- New seating arrangement eliminates nozzle.

CONSTANT DELIVERY PRESSURE...

with Airco's new high-efficiency single-stage station regulators

The new inverse type Airco Series 9900 Station Regulators are designed to help you improve welding and cutting operations in your industrial plant—scrap yard—steel mill—or railroad shop.

Specifically, the new Airco regulators are for pipeline service—oxygen, compressed air, acetylene, nitrogen, hydrogen, carbon dioxide, argon, helium, propane, or natural gas—with a pressure source under 200 p.s.i.

Ask your Airco Dealer for complete facts on these better tools to handle the job. Or call us direct.

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A division of Air Reduction Company, Incorporated
On the west coast— Air Reduction Pacific Company
In Canada— Air Reduction Canada Limited
Offices and dealers in most principal cities

Pannier

Neiley

Taylor

McElhoe

About people . . .

Georges Lucien Pannier has been appointed consulting engineer for Metallizing Company of Los Angeles, Inc. He will specialize in problems in metal spraying and high temperature ceramic coatings.

Richard Y. Neiley has been named district sales supervisor of Sperry Products, Inc., Danbury, Conn., manufacturer of ultrasonic inspection instruments. He will headquarter in Chicago. Neiley is a member of the Society for Nondestructive Testing.

William L. Fisher has been appointed eastern district sales manager of Aronson Machine Co., Arcade, N. Y. He will work exclusively in the welding positioner field.

L. F. Loutrel, president of Midwest Carbide Corp. for 29 years, has been elected chairman of the board and *James W. Dunham* of Chicago succeeds him as president.

Carl R. Gloskey, research manager at Metal & Thermit's Rahway, N. J. laboratories, has been awarded a Sloan Fellowship for advanced work at the School of Industrial Management at Massachusetts Institute of Technology, Cambridge, Mass.

Arnold Hildebrandt has been appointed product sales manager of Phoenix Products Co., Metal Spinning Div., Milwaukee, Wis. He will direct sales of electrode ovens.

K. H. Hunt has been promoted from superintendent to works manager of Air Reduction's new Chicago liquid oxygen plant. He succeeds *W. F. Grotevent* who has been transferred to a similar plant now being completed near Boston, Mass.

In a recent expansion of Smith Welding Equipment Corp.'s executive staff, *P. E. Taylor* became vice president in charge of production and personnel. *Ed Langston* was appointed district manager of the southeastern area, *Ray Cain* was named west coast district manager and *H. L. McElhoe* was made director of training, a newly created post in the Minneapolis firm's research and development department.

New territory managers are: *Gene Hill*, Charlotte, N. C.; *Frank Kolb*, Little Rock, Ark.; *Ray Puryear*, Chicamauga, Ga.; *Len Stuart*, Dallas; *Wes Westerson*, Ferguson, Mo. and *Dick Weimar*, who will be in export sales out of Minneapolis.

Chicago's *Gordon E. Burns* has been appointed distributor sales manager of General Electric's multi-million dollar receiving tube and electronic components replacement business. He will plan and direct sales policies and activities from headquarters in Owensboro, Ky.

John C. Cushing is assistant vice president (commercial) of Chicago's U. S. Steel Supply Div. of United States Steel Corp.

Robert C. Friedly and *Harold A. Hallstein, Jr.*, have been appointed product sales managers of Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio. They will coordinate field promotion and sales on special programs, primarily construction applications.

Friedly

Hallstein

P. J. Foley has been named general manager of resale operations for Worthington Corp.'s new resale operations activities. Four regional managers reporting to Foley are: *J. E. Seibold*, eastern region; *R. N. Franz*, central region; *J. T. Carroll*, midwest area; *M. H. Needham*, western region.

L. L. Ferrall has been elected executive vice president of Crucible Steel Co., Pittsburgh. *J. D. Dickerson* fills the vice president-operations spot vacated by Ferrall.

Edwin R. Wisner will serve as director of the new western sales office recently established by Budd Co., Philadelphia. He will headquarter in Los Angeles.

KSM Products, Merchantville, N. J., recently named *Walter A. Kiel* regional sales manager in the northeast. In the eastern region, *Charles P. Baker* will serve as sales engineer, while *Arthur Marriott* takes over sales activities in the southeast. Headquartering in Chicago will be *Nelson W. Gillis*, regional sales manager of the central region. *Claude Batuk* will serve in the home office as liaison sales engineer. In the Chicago area, *Howard Berndt* and *Joseph Golden* were named salesmen.

Marcel A. Cordovi has joined the staff of the Atomic Power Developments Section of the Development and Research Div. of International Nickel Co., New York. He was with Babcock and Wilcox Co., New York. He is a U. S. delegate to the International Institute of Welding and on the Welding Research Council.

F. V. Schilling has been selected district representative in Ohio, Indiana, and Illinois for Thermacote Co., Pasadena, Calif. He was district supervisor, welding application engineering, of Westinghouse Electric Corp. New Thermacote district representative in Wisconsin, Minnesota, North and South Dakota is *John Schroeder*. He will headquarter in Minneapolis.

Cordovi

Schilling

FEDREX
Industrial X-Ray Units

Available in Six Standard Models

Model	Power
120	120 KVP 4 MA
130	130 KVP 5 MA
160	160 KVP 5 MA
200	200 KVP 5 MA
260	260 KVP 5 MA
160/360*	160 KVP 3 MA

**360 Degree Head*

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1324 W. Fulton Chicago, Ill.

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FOR ALL HEAT-DEPENDENT OPERATIONS . . .

looks like a crayon
marks like a crayon
tells temperatures like a precision instrument

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000°F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

Also available in liquid and pellet form . . . Write **Welding Sales Dept.** for sample TEMPIL° pellets . . . State temperatures of interest — please!

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CORPORATION
132 WEST 22nd ST., NEW YORK 11, N. Y.

New appointments in Raybestos-Manhattan, Inc.'s central sales region went to: *A. N. Johnston, Jr.*, new manager to succeed the late *A. L. Hawk*, with headquarters in Chicago, and *H. P. McLaughlin*, Pittsburgh district manager who succeeds Johnston.

Dr. Spencer R. Milliken has been appointed research and development sales staff coordinator by Foote Mineral Co., Philadelphia. He joins Foote after five years with the Aluminum Company of America's research laboratories in New Kensington, Pa.

Sylvania Electric Products, Inc.'s new vice president of the Parts Div. is *Merle W. Kremer*. He will continue as general manager of the division, with headquarters in Warren, Pa.

John M. Welch has been appointed director of field sales for Olin Aluminum. He had been Chicago regional sales manager for the division of Olin Mathieson Chemical Corp.

The new position of special representative, national accounts has been assigned to *Stewart Monroe* by Raybestos-Manhattan, Inc., Passaic, N.J. *John McKinlay* succeeds Monroe as manager of the northeast district.

Pure Carbonic Co. has appointed *D. C. Giles* regional manager of its new Pacific Region, covering Berkeley, Los Angeles, Portland and Seattle districts. *D. B. Clapp, Jr.*, becomes regional sales manager in Los Angeles.

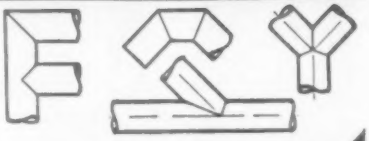
Richard H. Fogarty, Philadelphia, has been chosen a pipe welding engineer for Tube Turns Div., Chemetron Corp. Fogarty will headquarter in New York, and work with contractors, engineers and industrial piping users to solve welded piping problems.

Died . . .

James D. Glenn, 52, former vice-president and general manager of sales for Crucible Steel Co., died recently after a long illness. His home was in Pittsburgh.

One of the country's leading authorities on underwater welding and cutting, *Charles Kandel*, died April 21. Mr. Kandel, 69, was president of Craftweld Equipment Co., Long Island City, N.Y., which specialized in underwater equipment for cutting and welding.

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!



- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a **CONTOUR MARKER** — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

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1843 E. Compton Bl., Compton, Cal.
Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

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. . . the 2nd edition is just off the press. Get your copy now . . .

This cross-indexed volume contains 126 of the best Data Sheets appearing in WELDING ENGINEER in the past 15 years. Yet it costs only $1.40!

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Nationwide Acceptance
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TORCHIE
Enables Us to NOW SELL It
at Only $6.95

GET YOURS TODAY

Never Failing Instant Torch Lighting Anywhere on Any Job—No More Flints

Magnetically held on ANY unpainted metal surface. Saves its cost in Flints alone. Get one on 30 days trial from your regular dealer or write for name of one near you who stocks TORCHIE

THERMACOTE COMPANY
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Flood Finest Quality Fairly Priced
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Seamless and stoutly reinforced with new plastic, ratchet headgear. Easily adjusts to any headsize.

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Herb Reinhard, for 27 years secretary of the International Acetylene Association, died recently. Since 1945 he was manager of the Safety Codes Dept. of Linde Co. His interest in safety in handling acetylene earned him the Distinguished Service to Safety Award from the National Safety Council in 1955. In March of this year, he was chosen to moderate a panel conference on "Expanding safety activities through organization," at the President's conference on occupational safety, in Washington.

William Hunt Eisenman, 73, secretary and a founder-member of the American Society for Metals, died recently in a LaJolla, Calif., hospital. He had suffered a heart attack in his Palm Springs vacation home. For 40 years he served ASM, and was managing director of the annual Metal Show. He also directed the Western Metal Exposition and Congress held biennially at Los Angeles. Mr. Eisenman recently donated to the ASM a 100-acre tract on his farm near Cleveland, Ohio, where the $2 million headquarters building, "ASM of Tomorrow" will be built.

Dr. Vsevolod N. Krivobok, authority on stainless steels and supervisor of International Nickel Co.'s Stainless Steel and Heat-Resistant Alloy Section, died recently after a brief illness. He was 65.

While opening gifts at a 24th wedding anniversary celebration recently, *Fred Peters*, 58, suffered a heart attack and died. For 24 years he has owned the Fred Peters Welding Supply Co. in Chicago. Mr. Peters leaves his wife and five children.

S. S. (Cal) Callner, 58, president of S. S. Callner Associates, Chicago, died June 4 after a brief illness. Mr. Callner's firm has represented specialized welding lines in the Chicago area since 1940. He is survived by his wife, Stella.

Black Beauty
Singer's new lightweight safety clothing and gloves for inert gas arc welding

★Welders gloves and mittens

★ Jackets ★ Sleeves (all types)
★ Bib aprons ★ Split-leg aprons

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51. METALLIZING—Metallizing Co. of Los Angeles. Advantages of metallizing for coating machine parts, corrosion resistance, heat resistance and decorating and replica coating are listed in brochure.

52. HAND TRUCKS—Chicago Manufacturing & Distributing Co. Circular, "Hand trucks with a purpose," covers dolly trucks and bag-holding trucks.

53. WELDED BOILER TUBES—Babcock & Wilcox Co. Data card TDC-157 lists maximum allowable working pressures, by popular sizes, of electric resistance welded carbon steel boiler tubing.

54. FLAME-CUTTING—Linde Co. New folder 1057 "Cut your flame-cutting costs," tells how to reduce costs with quality nozzle construction and proper nozzle selection.

55. STAINLESS CHART—Peter A. Frasse & Co., Inc. Chart Sec. A, No. 8 gives information on relative corrosion resistance of 34 standard grades of stainless steel. Traces development in 4 basic groups of alloys.

56. WELDING ACCESSORIES—Fibre Metal Products Co. Catalog 26 pictures line of welding accessories and safety equipment, including helmets, hand shields, hats and caps, connectors, etc.

57. A-C WELDER — Ergolyte Mfg. Co. Illustrated page details Models 161 and 251 standard a-c welders, gives general specifications.

58. RESISTANCE WELDERS—Alphil Spot Welder Mfg. Corp. Bulletin lists flash, projection, butt, spot and gun welders specially designed for sheet metal, wrought iron, wire fabricating and tubing industries.

59. WELDING CABLE — Phelps Dodge Copper Products Corp. Page covers "Habirprene" arc welding cable, gives specifications, recommended cable size.

60. TRANSFORMERS — Eisler Transformer Co., Inc. Four-page brochure TR-58 shows firm's new facilities and types of transformers built.

61. ELECTRODE SELECTOR—Alloy Rods Co. Bulletin AR20-2 is 40-page pocket size "Electrode selector guide" listing ASTM steel classifications and recommended electrodes for welding each grade.

62. ULTRASONIC CLEANERS — Narda Ultrasonics Corp. Series 600 ultrasonic cleaners described in data sheet 600.

63. CERAMIC SHAPES—Diamonite Products Mfg. Co. Catalog sheet explains high alumina ceramic custom shapes used in induction heating, welding and brazing. Lists physical properties, characteristics.

64. PURCHASING—All-State Welding Alloys Co., Inc. In reference form is data for buyers of specialty alloys and fluxes.

65. STUD WELDING—Graham Mfg. Corp. Bulletin covers firm's process of stored energy stud welding. Pictures welders, explains process.

66. TEMPERATURE MEASUREMENT —The Pyrometer Instrument Co., Inc. Catalog No. 175 covers instruments for precision temperature measurements, including optical, micro-optical, radiation, immersion, surface and indicating.

67. ARC WELDING—Resistance Welder Corp. Arc welding bulletin ARC 5803 gives examples of automatic arc welding machines.

68. BRAZING ALLOY—Wall Colmonoy Corp. Two-color engineering data sheet 21 explains high-temperature brazing alloy No. 150. Gives nominal composition, metallurgical properties, application recommendations.

69. FIRST AID — Emergency Equipment Co. Unit system of industrial first aid has plastic inspection window for quick checking. Bulletin 333 details kit.

70. PACKAGING MACHINE — Product Packaging Engineering. Illustrated 8-page bulletin describes packaging machine which feeds parts, heat seals, prints, cuts off and counts bags automatically.

71. CONTROL VALVE — Hanna Engineering Works. Bulletin 275 describes "Flo-Set 1000" speed control valve. Suited for hydraulic pressures up to 1000 psi.

72. REGULATORS—Linde Co. Industrial gas regulators detailed in 20-page catalog 4490 which includes specifications and ordering information for 47 regulators.

73. PRODUCTION PROBLEMS—Oilgear Co. "Fluid power news 5" deals with customers' production problems and solutions, including metalworking field.

74. NICKEL-CLAD COPPER — Sylvania Electric Products, Inc. Bulletin "Kulgrid 28, nickel clad copper wire," gives chemical composition, mechanical properties, conductivity and resistivity of nickel-clad copper wire for high temperature applications.

75. VENTS—Flexible Tubing Corp. Bulletin describes line of venting kits and components for all types of installations.

76. SHEAR—Vogel Tool & Die Corp. Illustrated page covers "Arc-snug" which shears clean for notching, welding.

77. RADIATION PROTECTION—O. G. Kelley & Co. Page describes firm's lead radiation protection.

78. SAFETY TALKS — National Safety Council. Publication "Five minute safety talks for foremen," is designed to promote safety in industry.

79. ASTE DATA SHEETS — Universal Vise and Tool Co. ASTE data sheets 34-93150 give specifications and dimensions of 3-way machine vises, universal rotary tables, adjustable lathe fixtures, plain and swivel base machine vises, angle plates, etc.

80. MILD STEEL—Sciaky Bros, Inc. 45-page engineering report gives tentative design standards for resistance formed welds in mild steel.

81. PYROMETER—Illinois Testing Laboratories, Inc. Leaflet covers indicating-controlling pyrometer, other precision instruments.

82. STEAM TRAPS—Tempil Corp. Handy reference card gives steam trap data for spotting defective steam traps.

83. GRINDING WHEELS—Cincinnati Milling Machine Co. Brochure "Cincinnati toolroom grinding wheels" PG-350 gives features and application for general toolroom and cutter and tool grinding.

84. WELDING SYSTEM—Air Reduction Sales Co. Catalog 2350 covers "Aircomatic" welding equipment, including pull, push guns, wire feeders, arc welding machines, welding wire regulators, etc.

85. STEEL CHAIN—Taylor-Wharton Co. Catalog features line of manganese steel chains, including heavy industrial applications.

86. REBUILD UNIT — Wincar Welders. "Tractorol" for automatically rebuilding tractor rollers and idlers is covered in illustrated folder. Includes specifications, price list.

87. SWITCHES—Gordos Corp. Mercury switches thoroughly detailed in 8-page catalog.

88. COMPRESSED GASES—The Matheson Co., Inc. Compressed gases and gas regulators treated in attractive 35-page bulletin.

89. FLASH-BUTT WELDING — Taylor-Winfield Corp. New 16-page bulletin 7-913 describes flash-butt welding process and outlines types of clamping and flash and upset mechanisms.

90. ALL-PURPOSE UNIT — NCG Div., Chemetron Corp. Portable, electric motor-driven, track-guided machine "The Beetle" that can be equipped for automatic welding, cutting and heat-treating described in bulletin N-141.

91. METAL FORMING—Alpha-Molykote Corp. Bulletin 304, "Lubrication newsletter," covers reduction in metal pickup on dies in metal forming operations when lubricating dies.

92. TORCH CHART—Harris Calorific Co. Two-color welding torch chart is reference to welding and cutting tips and attachments for use on No. 43 torch.

93. GRINDING—Robertson Mfg. Co. Bulletin "Tool room grinding with Robertson wheels" contains tables of wheel types, cylindrical grinding, etc.

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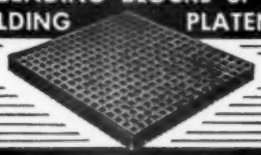

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125. Air Reduction Sales Co.—Write for literature on Airco's new 3-tube cutting attachments.

126. Air Reduction Sales Co.—Catalog 1318, Airco Electrode Guide will help you select the right electrode for your specific job.

127. Air Reduction Sales Co.—Write for complete facts on the high-efficiency single-stage station regulators.

128. Alloy Rods Co.—Bulletin HS-102 gives complete details on the "Wear-O-Matic" wire feed unit.

129. Alloy Rods Co.—Bulletin AR-10 will help you on your stainless steel welding problems.

130. All-State Welding Alloys Co., Inc. Folder on "Steelarc" electrodes available.

131. Aluminum Co. of America—Write for booklets and films that show how easy it is to weld, braze and solder aluminum.

132. Alva Allen Industries—Catalog available giving complete information, specifications and prices on Allen's heavy duty punch presses.

133. American Brass Co.—Publication B-13 with comprehensive information on Anaconda welding rods and procedures, is available.

134. American Messer Corp.—Further information on American Messer's oxygen cutting machines is available.

135. American Platinum & Silver Div.—Complete reference manuals for low-temperature silver brazing and fluxing are available.

136. American Solder and Flux Co.—Write for further information on galvanizing repair compounds.

137. Ampco Metal, Inc.—Bulletin W-17 available on Ampco-Trode 10 and other aluminum-bronze electrodes.

138. Aronson Machine Co.—Detailed engineering data available on Aronson's positioners.

139. Atlantic Abrasive Corp.—Write for a copy of the "Atlantic Grinding Wheel Catalog."

140. Atlas Welding Accessories, Inc.—Future information available on the Atlas line of weld cleaning tools.

141. Belden Mfg. Co.—Information available on Belden's engineered welding cables.

142. Contour Marker Corp.—Details on establishing and marking a point at any angle.

143. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

144. Coyne Cylinder Co.—Write for details on Coyne Acetylene Cylinders.

145. Duro Engineering Co.—Information on Duro's standard and "Durogon" holders available, also name and address of nearest distributor.

146. Flood Safety Products Co.—Further information available on fiber glass helmets manufactured by Flood, and other welding and safety equipment.

147. Goldsmith Bros. Smelting & Refining Co.—For complete information on low temperature silver brazing write for a copy of the GB data book.

148. H & M Pipe Beveling Machine Co.—Write for further information on H & M pipe cutting and beveling machines.

149. Handy & Harman—Bulletin 20 explains the values, techniques and economies of low-temperature silver brazing.

150. Harnischfeger Corp.—Bulletin R-29 available on low-hydrogen electrodes.

151. Harnischfeger Corp.—For further information on heat-treatable electrodes send for Bulletin R-48.

152. Harris Calorific Co.—Write for more details on the Gaugeless regulator.

153. Hobart Brothers Co.—Write for further information on Hobart's line of arc welders.

154. Hobart Brothers Co.—Catalog available on welding electrodes.

155. Independent Engineering Co.—Further information available on transporting compressed gases by gas supply trailers.

156. International Nickel Co.—Booklet available, "A Handy Guide To Welding Cast Iron."

157. Jackson Products—Further information available on "Cablehitch," the Jackson welding cable hanger.

158. Lenco, Inc.—Further information available on "Hi-Amp" ground clamps.

159. Lincoln Electric Co.—Write for literature on Lincoln's engine driven welders.

160. Linde Co.—Write for further information on Linde's guaranteed inert argon welding gas.

161. Liquid Carbonic—Complete technical data available on CO_2 shielded gas welding.

162. Lummis Mfg. Co.—Write for catalog on "Key-Bak's."

(Continued on page 82)

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Literature offered in ads

(Continued from page 80)

163. Machinery & Welder Corp.—Full details on several models of portable x-ray units.

164. Magnaflux Corp.—Write for new bulletin on Magnaflux scientific inspection service.

165. Merrill Brothers—Information on lifting clamps, twin and drum lifters, drum tilters and other material-handling devices.

166. Metal & Thermit Corp.—Write for a copy of the M&T Selector, an easy reference for finding the correct electrode for any application.

167. Miller Electric Mfg. Co.—Complete specifications and prices on Miller's welders is available.

168. National Carbide Co.—Information on calcium carbide available, also name of nearest supplier.

169. National Welding Equipment Co. —Write for brochure No. 4 on National's welding equipment.

170. Page Steel & Wire Div.—Write for "Welding Wire Comparison Chart" DH-1218, Folder DH-402A on submerged arc and inert gas welding wire and booklet DH-1277 on gas welding rods.

171. Phoenix Products Co.—Write for new booklet on Dry-Rod Ovens.

172. Rankin Mfg. Co.—Write for Ran-Check Charts and stickers for checking part surface wear.

173. Singer Glove & Mfg. Co.—Catalog on Singer's line of work gloves and safety clothing.

174. A. O. Smith Corp.—Write for further information on the A. O. Smith convertors, to convert any a-c welder to d-c.

175. Smith Welding Equipment Corp.—Further information available on the "Big 98" welding and cutting outfit.

176. Smith Welding Equipment Corp.—Write for more information on the "Handi-Heet" air LP-gas soldering torch kits.

177. Square D Company—Bulletin SM-277 explains the complete line of Square D's heavy industrial electrical equipment.

178. Stulz-Sickles Co.—Write for complete details on "Manganal" wedge bars.

179. Sylvania Electric Products Inc.—Information on color coded Tungsten electrodes.

180. Tempil Corp. — Information and sample pellets of temperature indicators; state temperature desired.

181. Tennessee Fabricating Co. — 32 page catalog showing 400 casting designs available.

182. Thermacote Co.—Further information available on the battery operated "Torchie" and where you can get one on a 30 day trial.

183. Tillman & Co., John—Write for catalog on weldor's gloves and garments.

184. Tuffaloy Dept., Air Reduction Sales Co.—Catalog and prices available on Tuffaloy spot-welding tips, welding tip holders and adapters.

185. United Wire & Supply Corp.—Booklet, "Low Temperature Brazing Engineering Facts and Data."

186. Victor Equipment Co.—Write for further information on Victor machine torches and tips.

187. Worthington Corp.—Write for the detailed bulletin on the new automatic welding head manipulator.

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
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For tips that save Sylvania is the preferred electrode

Welders say they prefer Sylvania Tungsten Electrodes because they tip easily and economically. Now Sylvania packs money-saving information on tipping with every package of welding electrodes. The leaflet "How to Avoid Waste" presents methods for proper re-tipping which are the results of experience and research.

It's just one more reason why, more than ever, welders prefer Sylvania electrodes and why your welding supply distributor is happy to serve you with the industry's only complete line.

Remember too, that for further protection against waste Sylvania electrodes are color-coded and packed in a protective wood filler.

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WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Low-Fuming Rod meets production line needs at Simmons Company

Many articles of steel in widespread use are, or can be, assembled at low cost by oxyacetylene braze welding. Where welds must be made inside a confined space, however, or where there are many welding stations along the assembly line, fuming can become a serious matter.

The steel tube frame of a Simmons lounge chair being assembled by braze welding with Anaconda-997 (Low Fuming) Bronze Welding Rod. It requires 16 welds with a minimum of welding time. (Insert) The finished chair.

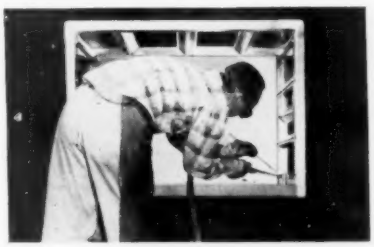
In plant after plant, the problem has been overcome by the use of Anaconda-997 Bronze Welding Rod. Its low-fuming characteristics make normal ventilation facilities adequate for the job. And its acceptance by weldors has been excellent.

Thus Anaconda-997 (Low Fuming) Bronze Welding Rod makes it possible to realize fully the advantages of braze welding under all production conditions. It offers the low temperature of application, excellent control, and the simplicity of joint and fixture design needed for efficient production. As the low temperatures do not melt the steel, the weld metal is very easily controlled, and there is no need for skilled manipulation of welding rod and flame, as in fusion welding. In addition, there is less tendency to distort the work because of the low temperatures used and the ductility of the weld metal.

SIMPLE FIXTURE DESIGN. In most cases the joints are of such size that they can be made in a single step by heating from one side only. This simplifies fixture design and reduces handling operations.

SAVINGS IN JOINT PREPARATION. The molten braze-welding alloy easily bridges the gaps resulting from poor fit-up, and readily builds up smooth fillets to develop maximum joint strengths. The cost of joint preparation is minimized since there is no need for extreme care in fit-up.

FLAME FLUXING. A widely used adjunct to braze-welding operations is a vapor-fluxing device, installed in the fuel-gas line, to supply a small but uniform amount of flux through the flame. In this way, the joint surfaces are protected from oxidation just as soon as heating is started, and the braze-welding operation is expedited through complete fluxing, increased weld fluidity, less tendency to fume, and elimination of separate flux deposits.



(Top) Weldor must make some of the 33 welds required inside the frame of the Simmons 3-drawer chest. Here low-fuming characteristics of Anaconda-997 Bronze Welding Rod are vitally important. Welding time for frame and drawers (4 welds each) is far less than obtained by previous methods. (Below) The finished 3-drawer chest.

FREE TECHNICAL ASSISTANCE. In most cases, Anaconda distributors can help you select the exact rod you need for your job. But if you have special problems, Anaconda welding engineers are at your service. For a copy of Publication B-13 with comprehensive information on Anaconda Welding Rods and procedures—or for technical assistance—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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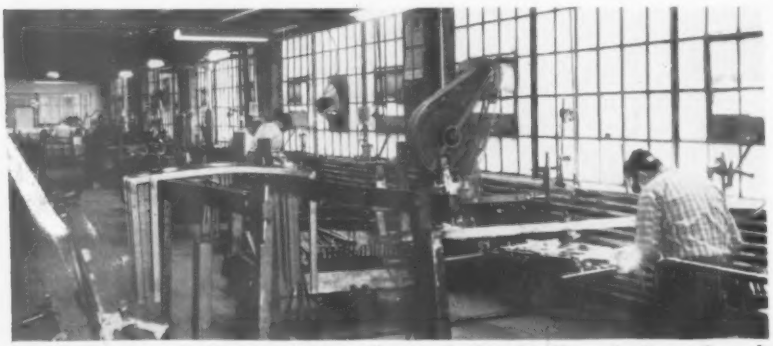

A portion of the braze-welding assembly line at Simmons Co., Kenosha, Wisc., a leading producer of furniture for institutions, such as steel-framed chairs, chests, cabinets, hospital beds, cribs, etc. Fuming problems were effectively controlled by use of Anaconda-997 (Low Fuming) Bronze welding rod.

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The American Brass Company